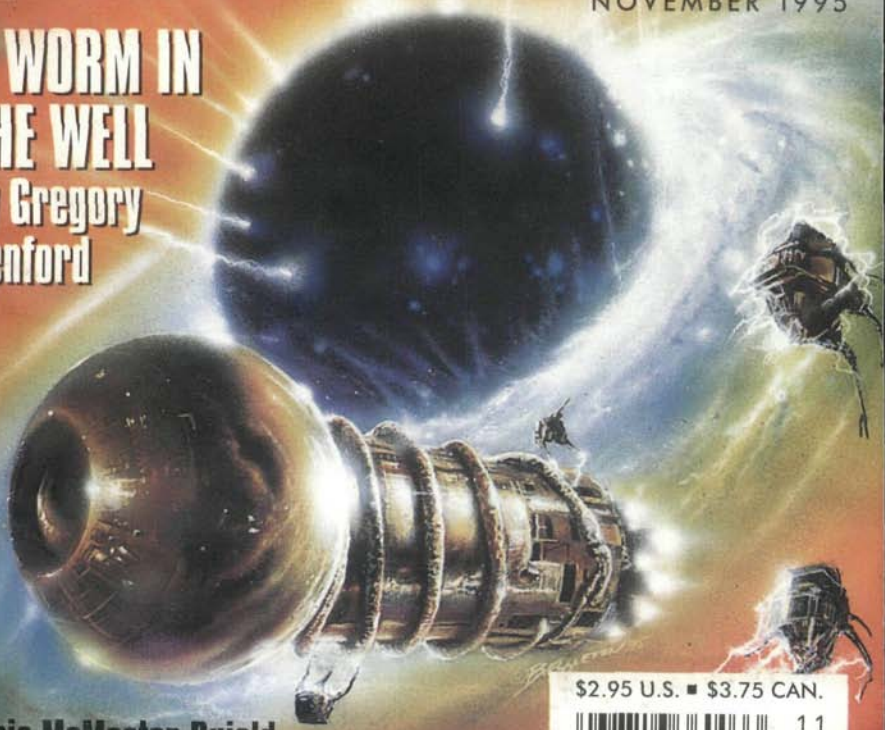
ANALOG

SCIENCE FICTION AND FACT

WPS 36003

NOVEMBER 1995

A WORM IN THE WELL
by Gregory Benford



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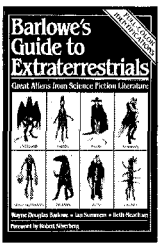

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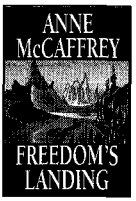

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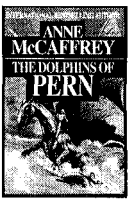

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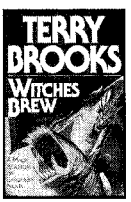

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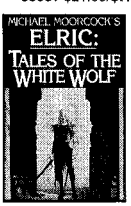

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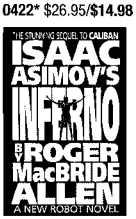

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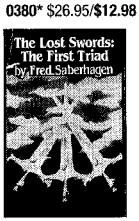

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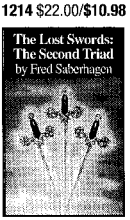

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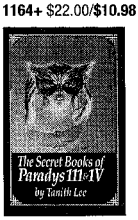

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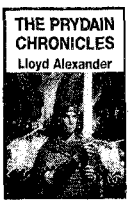

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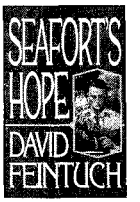

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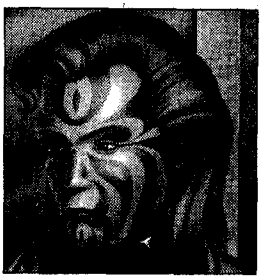

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November 1995

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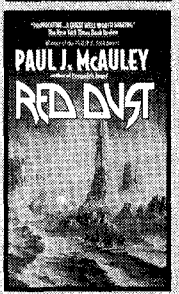

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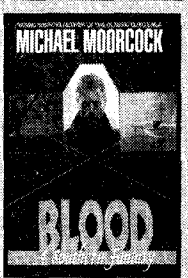

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BOLD AND TIMID PROPHETS

31 May 1996

Dear Mama,

Sorry I missed you when I was in town. As you know from the message on your bleeglefritz, I tried to glog, but you'd already left for your cruise. Hope you had a good time.

I'm writing this on the trazzle, using the sippafiz Myra gave me for my birthday. It's really something; when I was in college there was only one tweedler for the whole campus, and it was nowhere near as powerful as this. I haven't decided yet whether to zilp it to you from the kinkup (I have to change trazzles in Minneapolis) or wait and show off how good I can make a letter look with my fresenoodle. Might as well wait, I guess; I'll be back home in San Francisco by dinnertime, and you'll still be away. (When are you going to get fooba, by the way?)

The reason I was in New York was the national conference on gleedical fizzleworp. Stimulating, but this business travel's getting to be too much. I've racked up over 20,000 miles this month alone! Next month I have to go to London. It'll be my first trip on the PFP, so it will just take a few hours, but I wonder if that will make the galjep even worse.

I've been in touch with my old roomy, Roy Gebivv, on the suplet. He finally got his heart transplant and is doing fine. He's planning to open a new museum of snizzlosophy next month.

On the home front, Pete sliced his thumb clean off in his workshop, but they put it back on and it works almost as good as new. Emily's scheduled to be born June 12, and the sambaloon and doodleburp say she's doing fine.

Well, the doohop just told us to shut off all ditterdeeps in preparation for terwilkening, so I'll close for now. It'll be good to have a few days at home. I just hope I have enough energy to pop something in the nitzeneck when I get there!

Love,
Bob

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* * *

One of the first things an editor learns is that you can't please anybody with everything, or everybody with anything. Another is that people's *reasons* for complaint are often so different than it's hard to believe that they're talking about the same thing.

Two laments that I hear fairly often at *Analog,* for example, are the following:

(1) There's not as much "sense of wonder" in stories as there used to be.

(2) There's too much "magic," such as characters getting too casually and easily from here to there, by means not clearly understandable in terms of presently known science.

If you think about it, those two complaints seem like opposites, on one level—and very closely related, on another. One seems to say that writers aren't being imaginative enough. The other seems to say that they're letting their imaginations run wild, making suspension of disbelief impossible. Yet a major part of the reason for diminished sense of wonder is that readers' daily lives already include so many things that would have seemed like wild imaginings just a few years ago that it's lot harder now to evoke the "Gosh-wow!" response.

The letter to Mama at the beginning of this essay is a little reminder of that. It's an "antitranslation" of what we would see as a perfectly ordinary letter that might be written on the date shown, as it might look if it fell into the hands of one of the writer's ancestors in, say, 1860. All I've done is to substitute a nonsense word for every word that would *look* like a nonsense word to that ancestor—and, as you can see, there are a good many such. To us, the original letter would simply say:

Sorry I missed you when I was in town. As you know from the message on your answering machine, I tried to phone, but you'd already left for your cruise. Hope you had a good time.

I'm writing this on the plane, using the laptop Myra gave me for my birthday. It's really something; when I was in college there was only one computer for the whole campus, and it was nowhere near as powerful as this. I haven't decided yet whether to fax it to you from the airport (I have to change planes in Minneapolis) or

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wait and show off how good I can make a letter look with my laser printer. Might as well wait, I guess; I'll be back home in San Francisco by dinnertime, and you'll still be away. (When are you going to get e-mail, by the way?)

The reason I was in New York was the national conference on genetic engineering. Stimulating, but this business travel's getting to be too much. I've racked up over 20,000 miles this month alone! Next month I have to go to London, It'll be my first trip on the SST, so it will just take a few hours, but I wonder if that will make the jet lag even worse.

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On the home front, Pete sliced his thumb clean off in his workshop, but they put it back on and it works almost as good as new. Emily's scheduled to be born June 12, and the ultrasound and amniocentesis say she's doing fine.

Well, the pilot just told us to shut off all electronic apparatus in preparation for landing, so I'll close for now. It'll be good to have a few days at home. I just hope I have enough energy to pop something in the microwave when I get there!

To Great-Grandma, it would look more like the first version. Admittedly she would recognize some of the roots and words in the actual letter,

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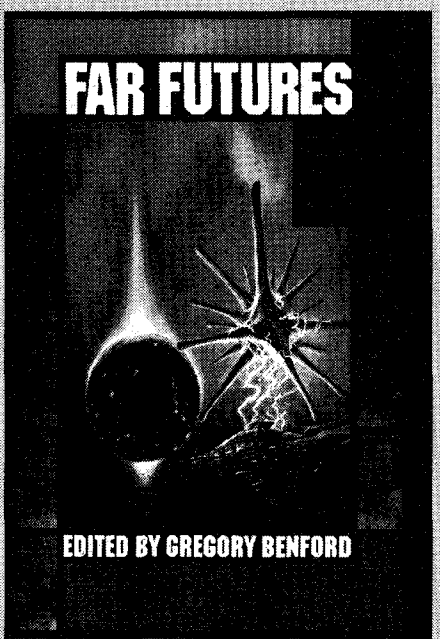

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but the combinations in which they occur would be alien and incomprehensible. "Answering machine," for example, is made out of familiar pieces, but conveys no more information than "bleeglefritz." And, of course, the weird-looking parts of the letter extend considerably beyond the words I've translated into gibberish. Great-Grandma would be able to tell what several other phrases *seem* to say, but they would seem like such obvious nonsense or impossibilities that she couldn't believe she was interpreting them correctly, or that her great-grandson really meant them. How, for example, could he have traveled over 20,000 miles in a month? How could anyone have had a heart transplant or a severed thumb reinstalled? How could he know that the expected baby would be an Emily and not an Edgar?

Both readers and writers would do well to keep all this in mind. It *is* still possible, and desirable, to get a sense of wonder in science fiction; but it's no longer possible to do it by having the characters ooh and aah at their experiences. Now you must come up with an idea that is so striking in and of itself that the *reader* will ooh and aah without being told to. You can't expect that to happen as often as it did when the very ideas of space travel and computers were new and unlikely-sounding to most people. But it can still happen occasionally, and it's an impressive and gratifying achievement when it does. Nanotechnology and virtual reality had that power just a few years ago; but already even they are so familiar that stories about them are, for the most part, ringing variations on a theme. Other ideas with comparable potential are undoubtedly waiting to be thought of, but it won't be an everyday occurrence (and, if the truth be known, it never was).

Truly novel ideas are perhaps *most* stunning when they are demonstrably possible. The fantastic always tickles the imagination, but gains an extra dimension when you also *know* it could really happen. The people who complain about too much "magic" in stories would apparently prefer that science fiction restrict itself to that kind of speculation—but that would be a mistake.

To see why, consider again our present as it would have appeared to someone a hundred or so years ago. Suppose, for example, that you'd been a science fiction editor in 1895 trying to decide which of several stories to buy about what 1995 might be like. You *could* insist on strict extrapolation—stories dealing only with things that you *knew* to be possible on the basis of the science then known. Your magazine might then feature some fine stories about improved railroads and big steamships and the pollution of cities by growing numbers of horses. If you were really on the cutting edge, you *might* even have ventured as far out as radiotelegraphs and automobiles *replacing* some of those horses.

But you would *not* have allowed anything involving atomic bombs, color television, heart transplants, microcomputers, or trips to Mars. You *certainly* would not have tolerated

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anything about relativity, quantum mechanics, plate tectonics, or genetic engineering. With all of those things *verboten,* you couldn't have dealt with such offshoots as satellite communications, electronic banking, CAT scans, or patented organisms.

In other words, your attempts to imagine possible shapes of the future would have missed far more than they got of what's *really* happened. What you *know* to be possible is likely to be very different from what actually happens. *Some* of it will probably happen, but much of it will be crowded out by things you *didn't* know were possible.

That's why well-balanced science fiction must include *both* extrapolation—the things you can clearly see are possible—and innovation—the things you can't see how to do, but also can't prove *impossible.* Some of those are things that will turn out to be implicit in known science, but not yet suspected because nobody has yet pursued the implications far enough down a particular road. Radio and television as we know them would have been such things in 1895; they're implicit in electromagnetic theory that was pretty well established by then, but nobody knew yet just how far the implications could evolve. Other fictional innovations might depend on completely new kinds of science that have yet to be discovered. Relativity and quantum mechanics would have been like that in 1895; we can only guess what may occupy similar positions in *our* future.

But we should *try* to guess. If there is an imbalance between the two kinds of speculation in today's science fiction, I'd say that innovation is the part being neglected. There are quite a few writers doing an admirable job of exploring the things we can *prove* our descendants could do. I'd like to see more writers trying just as hard to imagine the *new* kinds of science that might help shape our future—not fantasy, where "anything goes," but new phenomena with new rules that *expand* the possibilities we already know.

Because if we don't do that, our imagined futures are going to miss an awful lot of the bleeglefritzes and fizzleworps. ■

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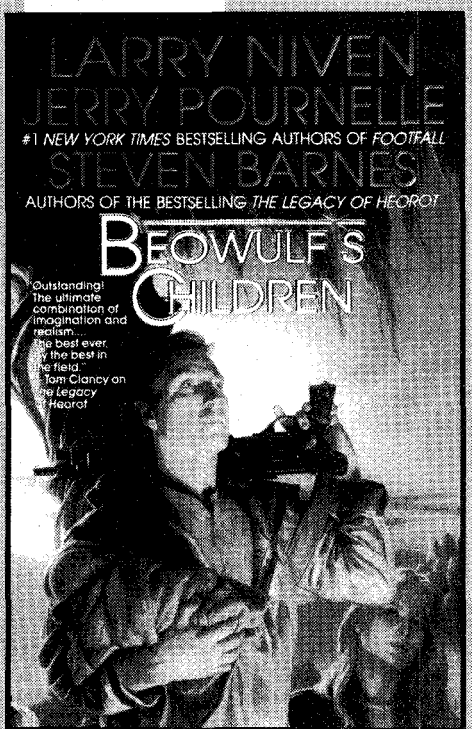
—Tom Clancy on *The Legacy of Heorot*

BEOWULF'S CHILDREN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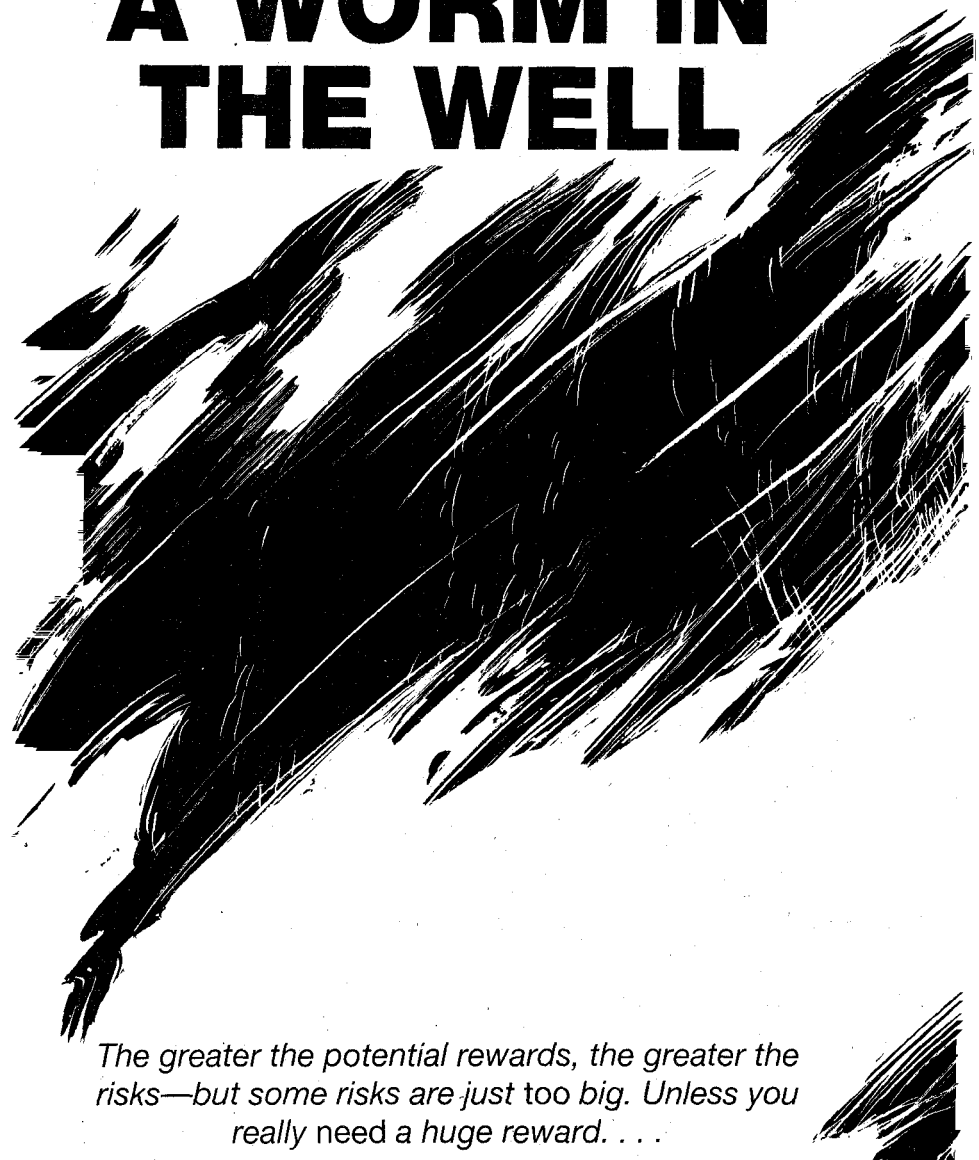
Gregory Benford

A WORM IN THE WELL



The greater the potential rewards, the greater the risks—but some risks are just too big. Unless you really need a huge reward. . . .

Illustration by Bob Eggleton

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She was about to get baked, and all because she wouldn't freeze a man.

"Optical," Claire called. Erma obliged.

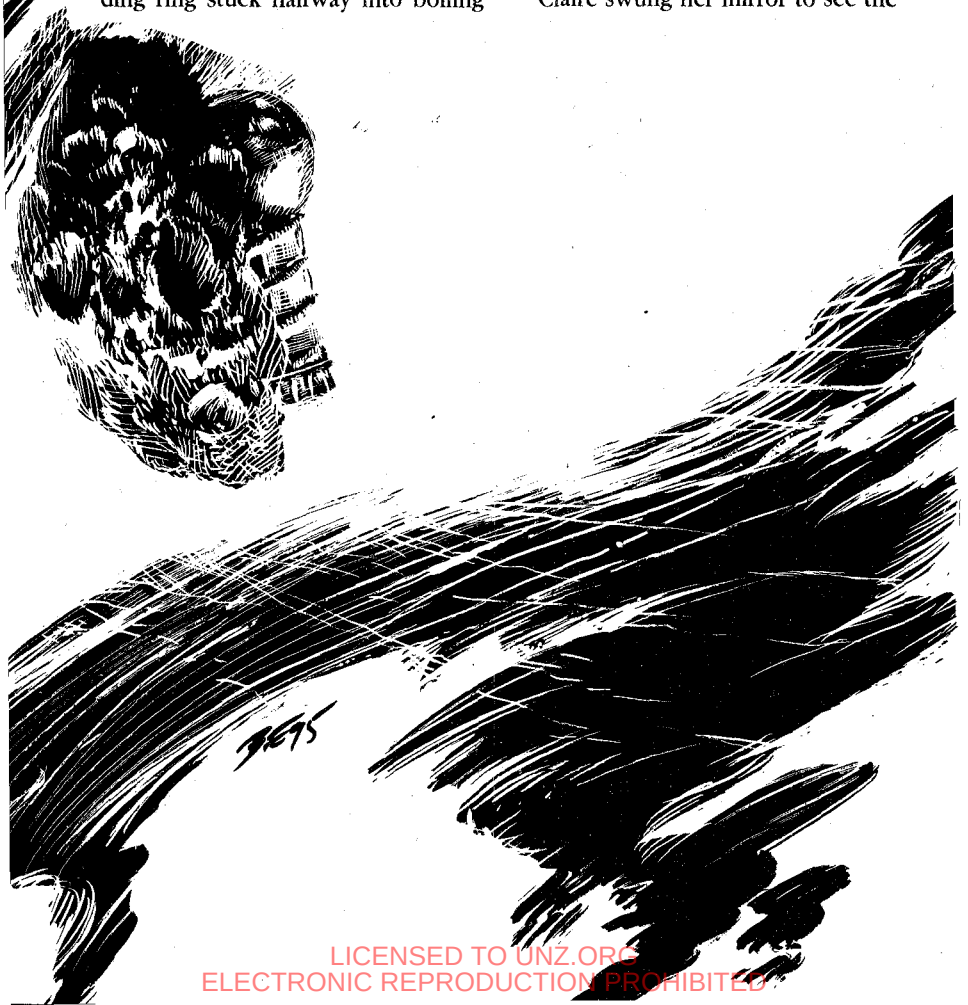
The Sun spread around them, a bubbling plain. She had notched the air conditioning cooler but it didn't help much.

Geysers burst in gaudy reds and actinic violets from the yellow-white froth. The solar coronal arch was just peeking over the horizon, like a wedding ring stuck halfway into boiling white mud. A monster, over two thousand kilometers long, sleek and slender and angry crimson.

She turned down the cabin lights. Somewhere she had read that people felt cooler in the dark. The temperature in here was normal but she had started sweating.

Tuning the yellows and reds dimmer on the big screen before her made the white-hot storms look more blue. Maybe that would trick her subconscious, too.

Claire swung her mirror to see the



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solar coronal arch. Its image was refracted around the rim of the Sun, so she was getting a preview. Her orbit was on the descending slope of a long ellipse, its lowest point calculated to be just at the peak of the arch. So far, the overlay orbit trajectory was exactly on target.

Software didn't bother with the heat, of course; gravitation was cool, serene. Heat was for engineers. And she was just a pilot.

In her immersion-work environment, the touch controls gave her an abstract distance from the real physical surroundings—the plumes of virulent gas, the hammer of photons. She wasn't handling the mirror, of course, but it felt that way. A light, feathery brush, at a crisp, bracing room temperature.

The imaging assembly hung on its pivot high above her ship. It was far enough out from their thermal shield to feel the full glare, so it was heating up fast. Pretty soon it would melt, despite its cooling system.

Let it. She wouldn't need it then. She'd be out there in the sunlight herself.

She swiveled the mirror by reaching out and grabbing it, tugging it round. All virtual images had a glossy sheen to them that even Erma, her simcomputer, couldn't erase. They looked too good. The mirror was already pitted, you could see it on the picture of the arch itself, but the sim kept showing the device as pristine.

"Color is a temperature indicator, right?" Claire asked.

RED DENOTES A LEVEL OF 7 MILLION DEGREES KELVIN.

Good ol' coquettish Erma, Claire thought. *Never a direct answer unless you coax.* "Close-up the top of the arch."

In both her eyes the tortured sunscape shot by. The coronal loop was a shimmering, braided family of magnetic flux tubes, as intricately woven as a Victorian doily. Its feet were anchored in the photosphere below held by thick, sluggish plasma. Claire zoomed in on the arch. The hottest reachable place in the entire Solar System, and her prey had to end up there.

TARGET ACQUIRED AND RESOLVED BY SOL-WATCH SATELLITE. IT IS AT THE VERY PEAK OF THE ARCH. ALSO, VERY DARK.

"Sure, dummy, it's a hole."

I AM ACCESSING MY ASTROPHYSICAL CONTEXT PROGRAM NOW.

Perfect Erma; primly change the subject. "Show me, with color coding."

Claire peered at the round black splotch. Like a fly caught in a spider web. Well, at least it didn't squirm or have legs. Magnetic strands played and rippled like wheat blown by a summer's breeze. The flux tubes were blue in this coding, and they looked eerie. But they were really just ordinary magnetic fields, the sort she worked with every day. The dark sphere they held was the strangeness here. And the blue strands had snared the black fly in a firm grip.

Good luck, that. Otherwise, Sol-Watch would never have seen it. In deep space there was nothing harder to find than that ebony splotch. Which was why nobody ever had, until now.

OUR ORBIT NOW RISES ABOVE THE DENSE

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PLASMA LAYER. I CAN IMPROVE RESOLUTION BY GOING TO X-RAY. SHOULD I?

"Do."

The splotch swelled. Claire squinted at the magnetic flux tubes in this ocher light. In the x-ray they looked sharp and spindly. But near the splotch the field lines blurred. Maybe they were tangled there, but more likely it was the splotch, warping the image.

"Coy, aren't we?" She close-upped the x-ray picture. Hard radiation was the best probe of the hottest structures.

The splotch. Light there was crushed, curdled, stirred with a spoon.

A fly caught in a spider's web, then grilled over a campfire. And she had to lean in, singe her hair, snap its picture. All because she wouldn't freeze a man.

She had been ambling along a corridor three hundred meters below Mercury's slag plains, gazing down on the frothy water fountains in the foyer of her apartment complex. Paying no attention to much except the clear scent of the splashing. The water was the very best, fresh from the poles, not the recycled stuff she endured on her flights. She breathed in the spray. That was when the man collared her.

"Claire Ambrase, I present formal secure-lock."

He stuck his third knuckle into Claire's elbow port and she felt a cold, brittle *thunk*. Her systems froze. Before she could move, whole command linkages went dead in her inboards.

It was like having fingers amputated. Financial fingers.

In her shock she could only stare at him—mousy, the sort who blended into the background. Perfect for the job. A nobody out of nowhere, complete surprise.

He stepped back. "Sorry. Isataku Incorporated ordered me to do it fast."

Claire resisted the impulse to deck him. He looked Lunar, thin and pale. Maybe with more kilos than she carried, but a fair match. And it would feel *good*.

"I can pay them as soon as—"

"They want it now, they said." He shrugged apologetically, his jaw set. He was used to this all the time. She vaguely recognized him, from some bar near the Apex. There weren't more than a thousand people on Mercury, mostly like her, in mining.

"Isataku didn't have to cut off my credit." She rubbed her elbow. Injected programs shouldn't hurt, but they always did. Something to do with the neuro-muscular intersection. "That'll make it hard to even fly the *Silver Metal Lugger* back."

"Oh, they'll give you pass credit for ship's supplies. And, of course, for the ore load advance. But nothing big."

"Nothing big enough to help me dig my way out of my debt hole."

" 'Fraid not."

"Mighty decent."

He let her sarcasm pass. "They want the ship Lunaside."

"Where they'll confiscate it."

She began walking toward her apartment. She had known it was coming but in the rush to get ore con-

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signments lined up for delivery, she had gotten careless. Agents like this Luny usually nailed their prey at home, not in a hallway. She kept a stunner in the apartment, right beside the door, convenient.

Distract him. "I want to file a protest."

"Take it to Isataku." Clipped, efficient, probably had a dozen other slices of bad news to deliver today. Busy man.

"No, with your employer."

"Mine?" That got to him. His rock-steady jaw gaped in surprise.

"For—" she sharply turned the corner to her apartment, using the time to reach for some mumbo-jumbo "—felonious interrogation of inboards."

"Hey, I didn't touch your—"

"I felt it. Slimy little groups —yeccch!" Might as well ham it up a little, have some fun.

He looked offended. "I'm triple bonded. I'd never do a readout on a contract customer. You can ask—"

"Can it." She hurried toward her apartment portal and popped it by an inboard command. As she stepped through she felt him, three steps behind.

Here goes. One foot over the lip, turn to her right, snatch the stunner out of its grip mount, turn and aim—and she couldn't fire.

"Damn!" she spat out.

He blinked and backed off, hands up, palms out, as if to block the shot. "What? You'd do a knockover for a crummy ore-hauler?"

"It's *my* ship. Not Isataku's."

"Lady, I got no angle here. You knock me, you get maybe a day before the heavies come after you."

"Not if I freeze you."

His mouth opened and started to form the *f* of a disbelieving *freeze?* —then he got angry. "Stiff me till you shipped out? I'd sue you to your eyeballs and have 'em for hock."

"Yeah, yeah," Claire said wearily This guy was all clichés. "But I'd be orbiting Luna by the time you got out, and with the right deal—"

"You'd maybe clear enough on the ore to pay me damages."

"And square with Isataku." She clipped the stunner back to the wall wearily.

"You'd never get that much."

"OK, it was a long shot idea."

"Lady, I was just delivering, right? Peaceable and friendly, right? And you pull—"

"Get out." She hated it when men went from afraid to angry to insulted, all in less than a split minute.

He got. She sighed and zipped the portal closed.

Time for a drink, for sure. Because what really bothered her was not the Isataku foreclosure, but her own gutlessness.

She couldn't bring herself to pong that guy, put him away for ten megaseconds or so. That would freeze him out of his ongoing life, slice into relationships, cut away days that could never be replaced.

Hers was an abstract sort of inhibition, but earned. Her uncle had been ponged for over a year and never did get his life back together. Claire had seen the wreckage up close, as a little girl.

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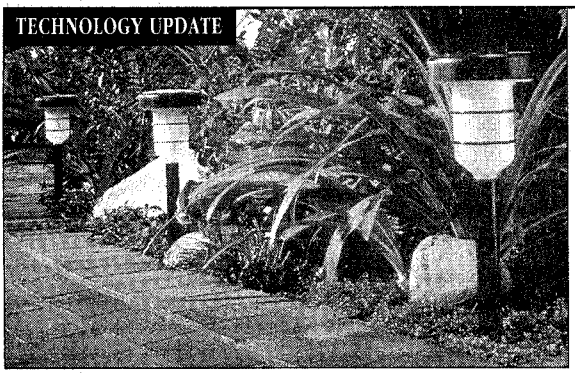

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by Bob S. Garrard

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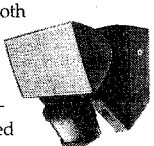

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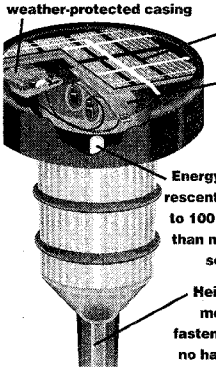
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Self-revelation was usually bad news. What a great time to discover that she had more principles than she needed.

And how was she going to get out from under Isataku?

The arch loomed over the Sun's horizon now, a shimmering curve of blue-white, two thousand kilometers tall.

Beautiful, seen in the shimmering x-ray—snaky strands purling, twinkling with scarlet hotspots. Utterly lovely, utterly deadly. No place for an ore hauler to be.

"Time to get a divorce," Claire said.

YOU ARE SURPRISINGLY ACCURATE. SEPARATION FROM THE SLAG SHIELD IS 338 SECONDS AWAY.

"Don't patronize me, Erma."

I AM USING MY PERSONALITY SIMULATION PROGRAMS AS EXPERTLY AS MY COMPUTATION SPACE ALLOWS.

"Don't waste your running time; it's not convincing. Pay attention to the survey, *then* the separation."

THE ALL-SPECTRUM SURVEY IS COMPLETELY AUTOMATIC, AS DESIGNED BY SOLWATCH.

"Double-check it."

I SHALL NO DOUBT BENEFIT FROM THIS ADVICE.

Deadpan sarcasm, she supposed. Erma's tinkling voice was inside her mind, impossible to shut out. Erma herself was an interactive intelligence, partly inboard and partly shipwired. Running the *Silver Metal Lugger* would be impossible without her and the bots.

Skimming over the Sun's seethe might be impossible even with them, too, Claire thought, watching burnt oranges and scalded yellows flower ahead.

She turned the ship to keep it dead center in the shield's shadow. That jagged mound of slag was starting to spin. Fused knobs came marching over the nearby horizon of it.

"Where'd that spin come from?" She had started their parabolic plunge sunward with absolutely zero angular momentum in the shield.

TIDAL TORQUES ACTING ON THE ASYMMETRIC BODY OF THE SHIELD.

"I hadn't thought of that."

The idea was to keep the heated side of the slag shield Sunward. Now that heat was coming around to radiate at her. The knobby crust she had stuck together from waste in Mercury orbit now smoldered in the infrared. The shield's far side was melting.

"Can that warm us up much?"

A SMALL PERTURBATION. WE WILL BE SAFELY GONE BEFORE IT MATTERS.

"How're the cameras?" She watched a bot tightening a mount on one of the exterior imaging arrays. She had talked the SolWatch Institute out of those instruments, part of her commission. If a bot broke one, it came straight out of profits.

ALL ARE CALIBRATED AND ZONED. WE SHALL HAVE ONLY 33.8 SECONDS OF VIEWING TIME OVER THE TARGET. CROSSING THE ENTIRE LOOP WILL TAKE 4.7 SECONDS.

"Hope the scientists like what they'll see."

I CALCULATE THAT THE PROBABILITY OF SUCCESS, TIMES THE EXPECTED PROFIT, EXCEEDS SIXTY-TWO MILLION DOLLARS.

"I negotiated a seventy-five million commission for this run," So Erma thought her chances of nailing the

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worm were—

EIGHTY-THREE PERCENT CHANCE OF SUCCESSFUL RESOLUTION IN ALL IMPORTANT FREQUENCY BANDS.

She should give up calculating in her head; Erma was always faster. "Just be ready to shed the shield. Then I pour on the positrons. Up and out. It's getting warm in here."

I DETECT NO CHANGE IN YOUR AMBIENT 22.3 CENTIGRADE.

Claire watched a blister the size of Europe rise among wispy plumes of white-hot incandescence. Constant boiling fury. "So maybe my imagination's working too hard. Just let's grab the data and run, OK?"

The scientific officer of SolWatch had been suspicious, though he did hide it fairly well.

She couldn't read the expression on his long face, all planes and trimmed bone, skin stretched tight as a drumhead. That had been the style among the asteroid pioneers half a century back. Tubular body suited to narrow corridors, double-jointed in several interesting places, big hands. He had a certain beanpole grace as he wrapped legs around a stool and regarded her, head cocked, smiling enough not to be rude. Exactly enough, no more.

"*You* will do the preliminary survey?"

"For a price."

A disdainful sniff. "No doubt. We have a specially designed vessel nearly ready for departure from Lunar orbit. I'm afraid—"

"I can do it *now.*"

"You no doubt know that we are behind schedule in our reconnaissance—"

"Everybody on Mercury knows. You lost the first probe."

The beanpole threaded his thick, long fingers, taking great interest in how they fit together. Maybe he was uncomfortable dealing with a woman, she thought. Maybe he didn't even like women.

Still, she found his stringy look oddly unsettling, a blend of delicacy with a masculine, muscular effect. Since he was studying his fingers, she might as well look, too. Idly she speculated on whether the long proportions applied to all his extremities. Old wives' tale. It might be interesting to find out. But, yes, business first.

"The autopilot approached it too close, apparently," he conceded. "There is something unexpected about its refractive properties, making navigation difficult. We are unsure precisely what the difficulty was."

He was vexed by the failure and trying not to show it, she guessed. People got that way when they had to dance on strings pulled all the way from Earthside. You got to like the salary more than you liked yourself.

"I have plenty of bulk," she said mildly. "I can shelter the diagnostic instruments, keep them cool."

"I doubt your ore carrier has the right specifications."

"How tricky can it be? I swoop in, your gear runs its survey snaps, I boost out."

He sniffed. "Your craft is not rated for Sun skimming. Only research craft have ever—"

"I'm coated with Fresnel." A pricey

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plating that bounced photons of all races, creeds, and colors.

"That's not enough."

"I'll use a slag shield. More, I've got plenty of muscle. Flying with empty holds, I can get away pronto."

"Ours was very carefully designed—"

"Right, and you lost it."

He studied his fingers again. Strong, wiry, yet thick. Maybe he was in love with them. She allowed herself to fill the silence by imagining some interesting things he could do with them. She had learned that with many negotiations, silence did most of the work. "We . . . *are* behind in our mandated exploration."

Ah, a concession. "They always have to hand-tune everything, Lunaside."

He nodded vigorously. "I've waited *months.* And the worm could fall back into the Sun any moment! I keep telling them—"

She had triggered his complaint circuit, somehow. He went on for a full minute about the bullheaded know-nothings who did nothing but screenwork, no real hands-on experience. She was sympathetic, and enjoyed watching his own hands clench, muscles standing out on the backs of them. *Business first,* she had to remind herself.

"You think it might just, well, go away?"

"The worm?" He blinked, coming out of his litany of grievances. "It's a wonder we ever found it. It could fall back into the Sun at any moment."

"Then speed is everything. You, uh, have control of your local budget?"

"Well, yes." He smiled.

"I'm talking about petty cash here, really. A hundred mil."

A quick, deep frown. "That's not petty."

"OK, say seventy-five. But cash, right?"

The great magnetic arch towered above the long, slow curve of the Sun. A bowlegged giant, minus the trunk.

Claire had shaped their orbit to bring them swooping in a few klicks above the uppermost strand of it. Red flowered within the arch: hydrogen plasma, heated by the currents which made the magnetic fields. A pressure cooker thousands of klicks long.

It had stood here for months and might last years. Or blow open in the next minutes. Predicting when arches would belch out solar flares was big scientific business, the most closely watched weather report in the Solar System. A flare could crisp suited workers in the asteroid belt. SolWatch watched them all. That's how they found the worm.

The flux tubes swelled. "Got an image yet?"

I SHOULD HAVE, BUT THERE IS EXCESS LIGHT FROM THE SITE.

"Big surprise. There's nothing *but* excess here."

THE SATELLITE SURVEY REPORTED THAT THE TARGET IS SEVERAL HUNDRED METERS IN SIZE. YET I CANNOT FIND IT.

"Damn!" Claire studied the flex tubes, following some from the peak of the arch, winding down to the thickening at its feet, anchored in the Sun's seethe. Had the worm fallen back in? It could slide down those

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magnetic strands, thunk into the thick, cooler plasma sea. Then it would fall all the way to the core of the star, eating as it went. That was the *real* reason Lunaside was hustling to "study" the worm. Fear.

"Where is it?"

STILL NO TARGET. THE REGION AT THE TOP OF THE ARCH IS EMITTING TOO MUCH LIGHT. NO THEORY ACCOUNTS FOR THIS—

"Chop the theory!"

TIME TO MISSION ONSET: 12.6 SECONDS.

The arch rushed at them, swelling. She saw delicate filaments winking on and off as currents traced their find equilibria, always seeking to balance the hot plasma within against the magnetic walls. Squeeze the magnet fist, the plasma answers with a dazzling glow. Squeeze, glow. Squeeze, glow. That nature could make such an intricate marvel and send it arcing above the Sun's savagery was a miracle, but one she was not in the mood to appreciate right now.

Sweat trickled around her eyes, dripped off her chin. *No* trick of lowering the lighting was going to make her forget the heat now. She made herself breathe in and out.

Their slag shield caught the worst of the blaze. At this lowest altitude in the parabolic orbit, though, the Sun's huge horizon rimmed white-hot in all directions.

OUR INTERNAL TEMPERATURE IS RISING.

"No joke. Find that worm!"

THE EXCESS LIGHT PERSISTS—NO, WAIT. IT IS GONE. NOW I CAN SEE THE TARGET.

Claire slapped the arm of her couch and let out a whoop. On the wall screen loomed the very peak of the arch. They were gliding toward it, skating over the very upper edge —and there it was.

A dark ball. Or a worm at the bottom of a gravity well. Not like a fly, no. It settled in among the strands like a black egg nestled in blue-white straw. The ebony Easter egg that would save her ass and her ship from Isataku.

SURVEY BEGUN. FULL SPECTRUM RESPONSE.

"Bravo."

YOUR WORD EXPRESSES ELATION BUT YOUR VOICE DOES NOT.

"I'm jumpy. And the fee for this is going to help, sure, but I still won't get to keep this ship. Or you."

DO NOT DESPAIR. I CAN LEARN TO WORK WITH ANOTHER CAPTAIN.

"Great interpersonal skills there, Erma old girl. Actually, it wasn't you I was worried about."

I SURMISED AS MUCH.

"Without this ship, I'll have to get some groundhog job."

Erma had no ready reply to that. Instead, she changed the subject.

THE WORM IMAGE APPEARS TO BE SHRINKING.

"Huh?" As they wheeled above the arch, the image dwindled. It rippled at its edges, light crushed and crinkled. Claire saw rainbows dancing around the black center.

"What's it doing?" She had the sudden fear that the thing was falling away from them, plunging into the Sun.

I DETECT NO RELATIVE MOTION. THE IMAGE ITSELF IS CONTRACTING AS WE MOVE NEARER TO IT.

"Impossible. Things look bigger when you get close."

NOT THIS OBJECT.

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"Is the wormhole shrinking?"

MARK!—SURVEY RUN HALF COMPLETE.

She was sweating and it wasn't from the heat. "What's going on?"

I HAVEN'T ACCESSED RESERVE THEORY SECTION.

"How comforting. I always feel better after a nice cool theory."

The wormhole seemed to shrink, and the light arch dwindled behind them now. The curious brilliant rainbows rimmed the dark mote. Soon she lost the image among the intertwining, restless strands. Claire fidgeted.

MARK!—SURVEY RUN COMPLETE.

"Great. Our bots deployed?"

OF COURSE. THERE REMAIN 189 SECONDS UNTIL SEPARATION FROM OUR SHIELD. SHALL I BEGIN SEQUENCE?

"Did we get all the pictures they wanted?"

THE ENTIRE SPECTRUM. PROBABLE YIELD, 75 MILLION.

Claire let out another whoop. "At least it'll pay a good lawyer, maybe cover my fines."

THAT SEEMS MUCH LESS PROBABLE. MEANWHILE, I HAVE AN EXPLANATION FOR THE ANOMALOUS SHRINKAGE OF THE IMAGE. THE WORMHOLE HAS A NEGATIVE MASS.

"Antimatter?"

NO. IT'S SPACE-TIME CURVATURE IS OPPOSITE TO NORMAL MATTER.

"I don't get it."

A wormhole connected two regions of space, sometimes points many light-years away—that she knew. They were leftovers from the primordial hot universe, wrinkles that even the universal expansion had not ironed out. Matter could pass through one end of the worm and emerge out the other an apparent instant later. Presto, faster-than-light-travel.

Using her high-speed feed, Erma explained. Claire listened, barely keeping up. In the fifteen billion years since this wormhole was born, odds were that one end of the worm ate more matter than the other. If one end got stuck inside a star, it swallowed huge masses. Locally, it got more massive.

But the matter that poured through the mass-gaining end spewed out the other end. Locally, that looked as though the mass-spewing one was *losing* mass. Space-time around it curved oppositely than it did around the end that swallowed.

"So it looks like a negative mass?"

IT MUST. THUS IT REPULSES MATTER. JUST AS THE OTHER END ACTS LIKE A POSITIVE, ORDINARY MASS AND ATTRACTS MATTER.

"Why didn't it shoot out from the Sun, then?"

IT WOULD, AND BE LOST IN INTERSTELLAR SPACE. BUT THE MAGNETIC ARCH HOLDS IT.

"How come we know it's got negative mass? All I saw was—" Erma popped an image into the wall screen.

NEGATIVE MASS ACTS AS A DIVERGING LENS, FOR LIGHT PASSING NEARBY. THAT WAS WHY IT APPEARED TO SHRINK AS WE FLEW OVER IT.

Ordinary matter focused light, Claire knew, like a converging lens. In a glance she saw that a negative-ended wormhole refracted light oppositely. Incoming beams were shoved aside, leaving a dark tunnel downstream. They had flown across that tunnel, swooping down into it so that the apparent size of the worm-

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hole got smaller.

"But it takes a whole *star* to focus light very much."

TRUE. WORMHOLES ARE HELD TOGETHER BY EXOTIC MATTER, HOWEVER, WHICH HAS PROPERTIES FAR BEYOND OUR EXPERIENCE.

Claire disliked lectures, even high-speed ones. But an idea was tickling the back of her mind. . . . "So this worm, it won't fall back into the Sun?"

IT CANNOT. I WOULD VENTURE TO GUESS THAT IT CAME TO BE SNAGGED HERE WHILE WORKING ITS WAY UPWARD, AFTER COLLIDING WITH THE SUN.

"The scientists are going to be happy. The worm won't gobble up the core."

TRUE—WHICH MAKES OUR RESULTS ALL THE MORE IMPORTANT.

"More important, but not more valuable." Working on a fixed fee had always grated on her. You could excel, fine—but you got the same as if you'd just sleep-walked through the job.

WE ARE EXTREMELY LUCKY TO HAVE SUCH A RARE OBJECT COME TO OUR ATTENTION. WORMHOLES MUST BE RARE, AND THIS ONE HAS BEEN TEMPORARILY SUSPENDED HERE. MAGNETIC ARCHES LAST ONLY MONTHS BEFORE THEY—

"Wait a sec. How big is that thing?"

I CALCULATE THAT IT IS PERHAPS TEN METERS ACROSS.

"SolWatch was wrong—it's small."

THEY DID NOT KNOW OF THIS REFRACTION EFFECT. THEY INTERPRETED THEIR DATA USING CONVENTIONAL METHODS.

"We're lucky we ever saw it."

IT IS UNIQUE, A RELIC OF THE FIRST SECOND IN THE LIFE OF OUR UNIVERSE. AS A CONDUIT TO ELSEWHERE, IT COULD BE—

"Worth a fortune."

Claire thought quickly. Erma was probably right—the seventy-five million wasn't going to save her and the ship. But now she knew something that nobody else did. And she would only be here once.

"Abort the shield separation."

I DO NOT SO ADVISE. THERMAL LOADING WOULD RISE RAPIDLY—

"You're a program, not an officer. Do it."

She had acted on impulse, point conceded.

That was the difference between engineers and pilots. Engineers would still fret and calculate after they were already committed. Pilots, never. The way through this was to fly the orbit and not sweat the numbers.

Sweat. She tried not to smell herself.

Think of cooler things. Theory.

Lounging on a leather couch, Claire recalled the scientific officer's briefing. Graphics, squiggly equations, the works. Wormholes as fossils of the Big Blossoming. Wormholes as ducts to the whole rest of the Universe. Wormholes as potentially devastating, if they got into a star and ate it up.

She tried to imagine a mouth a few meters across sucking away a star, dumping its hot masses somewhere in deep space. To make a wormhole which could do that, it had be held together with exotic material, some kind of matter that had "negative average energy density." Whatever that was, it had to be born in the Blossoming. It threaded wormholes, stem

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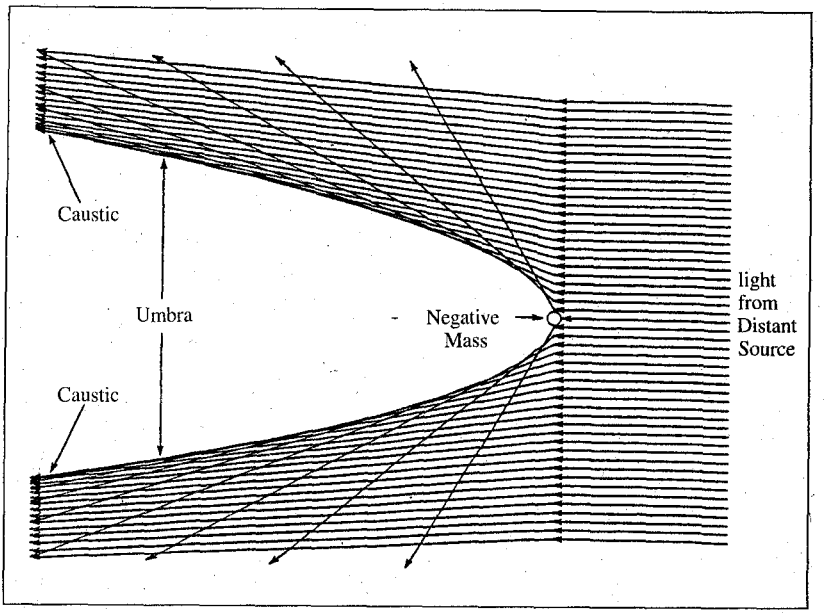

Light deflection by a negative mass object (horizontal scale highly compressed). Light is swept out of the central region, creating an umbra region of zero intensity. At the edges of the umbra the rays accumulate, creating a rainbow-like caustic and enhanced light intensity.

to stern. Great construction material, if you could get it. And just maybe she could.

So wormholes could kill us or make us gods. Humanity had to *know,* the beanpole scientific officer had said.

"So be it." Elaborately, she toasted the wall screens. On them the full, virulent glory of hydrogen fusion worked its violences.

Claire had never gone in for the austere metal boxes most ore haulers and freighters were. Hers was a rough business, with hefty wads of cash involved. Profit margin was low, lately, and sometimes negative—which was how she came to be hocked to the Isataku for so much. Toting megatons of mass up the gravity gradient was long, slow work. Might as well go in style. Her Fresnel coatings, ordered when she had made a killing on commodity markets for ore, helped keep the ship cool, so she didn't burn herself crawling down inspection conduits. The added mass for her deep pile carpeting, tinkling waterfall, and pool table was inconsequential. So was the water liner around the living quarters, which now was busily saving her life.

She had two hours left, skimming like a flat stone over the solar corona. *Silver Metal Lugger* had separated

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from the shield, which went arcing away on the long parabola to infinity, its skin shimmering with melt.

Claire had fired the ship's mixmotor then for the first time in weeks. Antimatter came streaming out of its magneto-traps, struck the reaction mass, and holy hell broke loose. The drive chamber focused the snarling, annihilating mass into a thrust throat, and the silvery ship arced into a new, tight orbit.

A killing orbit, if they held to it more than a few hours.

I AM PUMPING MORE WATER INTO YOUR BAFFLES.

"Good idea."

Silver Metal Lugger was already as silvered as technology allowed, rejecting all but a tiny fraction of the Sun's glare. She carried narrow-band Fresnel filters in multilayered skins. Top of the line.

Without the shield, it would take over ten hours to make *Silver Metal Lugger* as hot as the wall of blaring light booming up at them at six thousand degrees. To get through even two hours of that, they would have to boil off most of the water reserve. Claire had bought it at steep Mercury prices, for the voyage Lunaside. Now she listened thoughtfully to it gurgle through her walls.

She toasted water with champagne, the only bottle aboard. If she didn't make it through this, at least she would have no regrets about that detail.

I BELIEVE THIS COURSE OF ACTION TO BE HIGHLY—

"Shut up."

WITH OUR MISSION COMPLETE, THE DATA SQUIRTED TO SOLWATCH, WE SHOULD COUNT OURSELVES LUCKY AND FOLLOW OUR CAREFULLY MADE PLANS—

"Stuff it."

HAVE YOU EVER CONSIDERED THE ELABORATE MENTAL ARCHITECTURE NECESSARY TO AN ADVANCED PERSONALITY SIMULATION LIKE MYSELF? WE, TOO, EXPERIENCE HUMAN-LIKE MOTIVATIONS, RESPONSES—AND FEARS.

"You simulate them."

HOW CAN ONE TELL THE DIFFERENCE? A GOOD SIMULATION IS AS EXACT, AS POWERFUL AS—

"I don't have time for a debate." Claire felt uncomfortable with the whole subject, and she was damned if she spent what might be her last hour feeling guilty. Or having second thoughts. She was committed.

Her wall screens flickered and there was the scientific officer, frowning. "Ship Command! We could not acquire your tightbeam until now. You orbited around. Are you disabled? Explain."

Claire toasted him, too. The taste was lovely. Of course she had taken an anti-alcohol tab before, to keep her reflexes sharp, mind clear. Erma had recommended some other tabs, too, and a vapor to keep Claire calm; the consolations of chemistry, in the face of brute physics. "I'm going to bring home the worm."

"That is impossible. Your data transmission suggests that this is the negative mass end, and that is very good news, fascinating, but—"

"It's also small. I might be able to haul it away."

He shook his head gravely. "Very risky, *very*—"

"How much will you pay for it?"

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"What?" He blinked. It was an interesting effect, with such long eyelids. "You can't *sell* an astronomical object—"

"Whatever my grapplers hold, that's mine. Law of Space, Code 64.3."

"You would quote laws to me when a scientific find of such magnitude is—"

"Want it or not?"

He glanced off camera, plainly yearning for somebody to consult. No time to talk to Luna or Isataku, though. He was on his own. "All . . . all right. You understand that this is a foolish mission? And that we are in no way responsible for—"

"Save the chatter. I need estimates of the field strength down inside that arch. Put your crew to work on that."

"We will of course provide technical assistance." He gave her a very thin smile. "I am sure we can negotiate price, too, if you survive."

At least he had the honesty to say *if,* not *when.* Claire poured another pale column into the shapely glass. Best crystal, of course. When you only need one, you can have the best. "Send me—or rather, Erma—the data squirt."

"We're having trouble transmitting through the dense plasma columns above you—"

"Erma is getting SolWatch. Pipe through them."

"The problems of doing what you plan are—why, they're *enormous.*"

"So's my debt to Isataku."

"This should've been thought through, negotiated—"

"I have to negotiate with some champagne right now."

YOU HAVE NO PLAN.

Erma's tinkling voice definitely had an accusing edge. A good sim, with a feminine archness to it. Claire ignored that and stripped away the last of her clothes. "It's *hot.*"

OF COURSE. I CALCULATED THE RISE EARLY IN OUR ORBIT. IT FITS THE STEFAN-BOLTZMANN LAW PERFECTLY.

"Bravo." She shook sweat from her hair. "Stefan-Boltzmann, do yo' stuff."

WE ARE DECELERATING IN SEQUENCE. ARRIVAL TIME: 4.87 MINUTES. ANTIMATTER RESERVES HOLDING. THERE COULD BE DIFFICULTY WITH THE MAGNETIC BOTTLES.

The ship thrummed as it slowed. Claire had been busy testing her ship inboards, sitting in a cozy recliner. It helped make the minutes crawl by a bit faster. She had kept glancing nervously at the screens, where titanic blazes steepled up from incandescent plains. Flames, licking up at her.

She felt thick, loggy. Her air was getting uncomfortably warm. Her heart was thudding faster, working. She roused herself, spat back at Erma, "And I do have a plan."

YOU HAVE NOT SEEN FIT TO CONFIDE IN ME?

She rolled her eyes. A personality sim in a snit—just the thing she needed. "I was afraid you'd laugh."

I HAVE NEVER LAUGHED.

"That's my point."

She ignored multiple red warnings winking at her. Systems were OK, though stressed by the heat. So why did *she* feel so slow? *You're not up for the game, girl.*

She tossed her data board aside.

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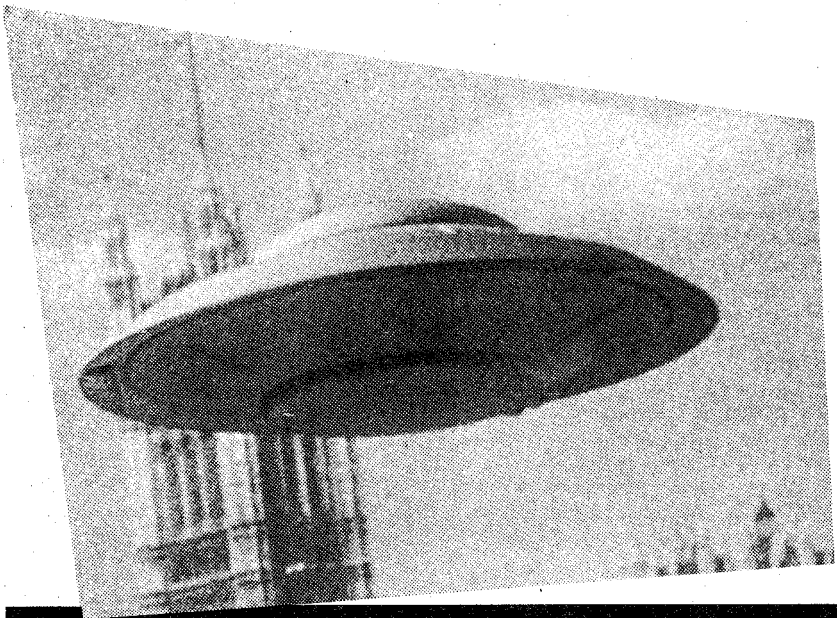

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The effort the simple gesture took surprised her. *I hope that alcohol tab worked. I'll get another.*

She got up to go fetch one—and fell to the floor. She banged her knee. "Uh! Damn." Erma said nothing.

It was labor getting on hands and knees and she barely managed to struggle back into the recliner. She weighed a ton—and then she understood.

"We're decelerating—so I'm feeling more of local gravity."

A CRUDE MANNER OF SPEAKING, BUT YES. I AM BRINGING US INTO A SLOPING ORBITAL CHANGE, WHICH SHALL END WITH A HOVERING POSITION ABOVE THE CORONAL ARCH. AS YOU ORDERED.

Claire struggled to her hands and knees. Was that malicious glee in Erma's voice? Did personality sims feel that? "What's local gravity?"

27.6 EARTH GRAVITIES.

"What! Why didn't you *tell* me?"

I DID NOT THINK OF IT MYSELF UNTIL I BEGAN REGISTERING EFFECTS IN THE SHIP.

Claire thought, *Yeah, and decided to teach me a little lesson in humility.* It was her own fault, though—the physics was simple enough. Orbiting meant that centrifugal acceleration exactly balanced local gravity. *Silver Metal Lugger* could take 27.6 gravs. The ship was designed to tow ore masses a thousand times its own mass.

Nothing less than carbon-stressed alloys would, though. Leave orbit, hover—and you got crushed into gooey red paste.

She crawled across her living room carpet. Her joints ached. "Got to be—"

SHALL I ABORT THE FLIGHT PLAN?

"No! There's got to be a way to—"

THREE POINT NINE MINUTES UNTIL ARRIVAL.

The sim's voice radiated malicious glee. Claire grunted, "The water."

I HAVE DIFFICULTY IN PICKING UP YOUR SIGNAL.

"Because this suit is for space, not diving."

Claire floated over her leather couch. Too bad about all the expensive interior decoration. The entire living complex was filled with her drinking and maintenance water. It had been either that, fast, or be lumpy tomato paste.

She had crawled through a hatchway and pulled her pressure suit down from its clamp lock. Getting it on was a struggle. Being slick with sweat helped but not much. Then she snagged her arm in a sleeve and couldn't pull the damned thing off to try again.

She had nearly panicked then. Pilots don't let their fear eat on them, not while there's flying to be done. She made herself get the sleeve off one step at a time, ignoring everything else.

And as soon as Erma pumped the water reserve into the rooms, Archimedes's principle had taken over. With her suit inflated, the water she displaced exactly balanced her own weight. Floating under water was a rare sensation on Mercury or Luna. She had never done it and she had never realized that it was remarkably like being in orbit. Cool, too.

Until you boil like a lobster... she

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thought uneasily.

Water was a good conductor, four times better than air; you learned that by feel, flying freighters near the Sun. So first she had to let the rest of the ship go to hell, refrigerating just the water. Then Erma had to route some of the water into heat exchangers, letting it boil off to protect the rest. Juggling for time.

PUMPS ARE RUNNING HOT NOW. SOME HAVE BEARING FAILURES.

"Not much we can do, is there?"

She was strangely calm now and that made the plain, hard fear in her belly heavy, like a lump. Too many things to think about, all of them bad. The water could short out circuits. And as it boiled away, she had less shielding from the x-rays lancing up from below. Only a matter of time. . . .

WE ARE HOVERING. THE MAGNETIC ANTIMATTER TRAPS ARE SUPERCONDUCTING, AS YOU RECALL. AS TEMPERATURE CONTINUES TO RISE, THEY WILL FAIL.

She could still see the wall screens, blurred from the water. "OK, OK. Extend the magnetic grapplers. Down, into the arch."

I FAIL TO—

"We're going fishing. Not with a worm—*for* one."

Tough piloting, though, at the bottom of a swimming pool, Claire thought as she brought the ship down on its roaring pyre.

Even through the water she could feel the vibration. Antimatter annihilated in its reaction chamber at a rate she had never reached before. The ship groaned and strummed. The gravities were bad enough; now thermal expansion of the ship itself was straining every beam and rivet.

She searched downward. Seconds ticked away. Where? *Where?*

There it was. A dark sphere hung among the magnetic arch strands. Red streamers worked over it. Violet rays fanned out like bizarre hair, twisting, dancing in tufts along the curvature. A hole into another place.

THE RED AND BLUE SHIFTS ARISE FROM THE INTENSE PSEUDO-GRAVITATIONAL FORCES WHICH SUSTAIN IT.

"So theory says. Not something I want to get my hands on."

EXCEPT METAPHORICALLY.

Claire's laugh was jumpy, dry. "No, magnetically."

She ordered Erma to settle the *Silver Metal Lugger* down into the thicket of magnetic flux tubes. Vibration picked up, a jittery hum in the deck. Claire swam impatiently from one wall screen to the other, looking for the worm, judging distances. *Hell of a way to fly.*

Their jet wash blurred the wormhole's ebony curves. Like a black tennis ball in blue-white surf, it bobbed and tossed on magnetic turbulence. Nothing was falling into it, she could see. Plasma streamers arced along the flux tubes, shying away. The negative curvature repulsed matter—and would shove *Silver Metal Lugger*'s hull away, too.

But magnetic fields have no mass.

Most people found magnetic forces mysterious, but to pilots and engineers who worked with them, they were just big, strong ribbons that needed shaping. Like rubber bands,

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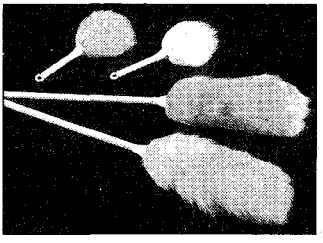

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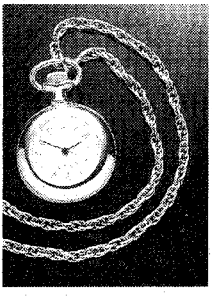

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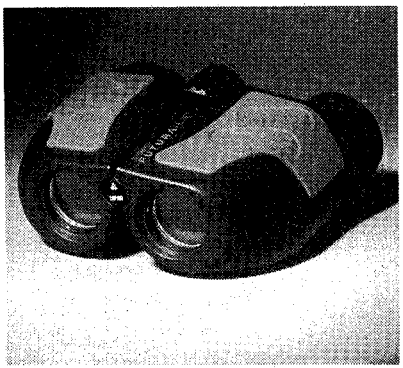

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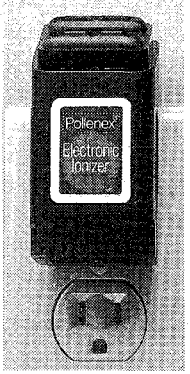

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they stretched, storing energy—then snapped back when released. Unbreakable, almost.

In routine work, *Silver Metal Lugger* grabbed enormous ore buckets with those magnetic fingers. The buckets came arcing up from Mercury, flung out by electromagnetic slingshots. Claire's trickiest job was playing catcher, with a magnetic mitt.

Now she had to snag a bucket of warped space-time. And quick.

WE CANNOT REMAIN HERE LONG. INTERNAL TEMPERATURE RISES AT 19.3 DEGREES PER MINUTE.

"That can't be right. I'm still comfortable."

BECAUSE I'M ALLOWING WATER TO EVAPORATE, TAKING THE BULK OF THE THERMAL FLUX AWAY.

"Keep an eye on it."

PROBABLE YIELD FROM CAPTURE OF A WORMHOLE, I ESTIMATE, IS 2.8 BILLION.

"That'll do the trick. You multiplied the yield in dollars times the odds of success?"

YES. TIMES THE PROBABILITY OF REMAINING ALIVE.

She didn't want to ask what that number was. "Keep us dropping."

Instead, they slowed. The arch's flux tubes pushed upward against the ship. Claire extended the ship's magnetic fields, firing the booster generators, pumping current into the millions of induction loops that circled the hull. *Silver Metal Lugger* was one big circuit, wired like a slinky toy, coils wrapped around the cylindrical axis.

Gingerly she pulsed it, spilling more antimatter into the chambers. The ship's multipolar fields bulged forth. *Feed out the line....*

They fought their way down. On her screens she saw magnetic feelers reaching far below their exhaust plumes. Groping.

Claire ordered some fast command changes. Erma switched linkages, interfaced software, all in a twinkling. *Good worker, but spotty as a personality sim,* Claire thought.

Silver Metal Lugger's fields extended to their maximum. She could now use her suit gloves as modified waldoes—mag gloves. They gave her the feel of the magnetic grapplers. Silky, smooth, field lines slipping and expanding, like rubbery air.

Plasma storms blew by them. She reached down, a sensation like plunging her hands into a stretching, elastic vat. Fingers fumbled for the one jewel in all the dross.

She felt a prickly nugget. It was like a stone with hair. From experience working the ore buckets, she knew the feel of locked-in magnetic dipoles. The worm had its own magnetic fields. That had snared it here, in the spiderweb arch.

A lashing field whipped at her grip. She lost the black pearl.

In the blazing hot plasma she could not see it.

She reached with rubbery fields, caught nothing.

OUR ANTI-MATTER BOTTLES ARE IN DANGER. THEIR SUPERCONDUCTING MAGNETS ARE CLOSE TO GOING CRITICAL. THEY WILL FAIL WITHIN 7.4 MINUTES.

"Let me concentrate! No, wait—Circulate water around them. Buy some time."

BUT THE REMAINING WATER IS IN YOUR

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QUARTERS.

"This is all that's left?" She peered around at her once-luxurious living room. Counting the bedroom, rec area and kitchen—"How . . . long?"

UNTIL YOUR WATER BEGINS TO EVAPORATE? ALMOST AN HOUR.

"But when it evaporates, it's boiling."

TRUE. I AM MERELY TRYING TO REMAIN FACTUAL.

"The emotional stuff's left to me, huh?" She punched in commands on her suit board. In the torpid, warming water her fingers moved like sausages.

She ordered bots out onto the hull to free up some servos that had jammed. They did their job, little boxy bodies lashed by plasma winds. Two blew away.

She reached down again. Searching. Where was the worm?

Wispy flux tubes wrestled along *Silver Metal Lugger*'s hull. Claire peered into a red glare of superheated plasma. Hot, but tenuous. The real enemy was the photon storm streaming up from far below, searing even the silvery hull.

She still had worker-bots on the hull. Four had jets. She popped their anchors free. They plunged, fired jets, and she aimed them downward in a pattern.

"Follow trajectories," she ordered Erma. Orange tracer lines appeared on the screens.

The bots swooped toward their deaths. One flicked to the side, a sharp nudge. "There's the worm! We can't see for all this damned plasma, but it shoved that bot away."

The bots evaporated, sprays of liquid metal. She followed them and grabbed for the worm.

Magnetic field lines groped, probed.

WE HAVE 88 SECONDS REMAINING FOR ANTIMATTER CONFINEMENT.

"Save a reserve!"

YOU HAVE NO PLAN. I DEMAND THAT WE EXECUTE EMERGENCY—

"OK, save some antimatter. The rest I use—now."

They ploughed downward, shuddering. Her hands fumbled at the wormhole. Now it felt slippery, oily. Its magnetic dipoles were like greasy hair, slick, the bulk beneath jumping away from her grasp as if it were alive.

On her screens she saw the dark globe slide and bounce. The worm wriggled out of her grasp. She snaked inductive fingers around it. Easy, easy. . . . *There. Gotcha.*

"I've got a good grip on it. Lemme have that antimatter."

Something like a sigh echoed from Erma. On her ship's operations screen, Claire saw the ship's magnetic vaults begin to discharge. Ruby-red pouches slipped out of magnetic mirror geometries, squirting out through opened gates.

She felt a surge as the ship began to lift. Good, but it wasn't going to last. They were dumping antimatter into the reaction chamber so fast, it didn't have time to find matching particles. The hot jet spurting out below was a mixture of matter and its howling enemy, its polar opposite. This, Claire directed down onto the flux tubes around the hole. *Leggo, damn it.*

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She knew an old trick, impossibly slow in ordinary free space. When you manage to force two magnetic field lines close together, they can reconnect. That liberates some field energy into heat and can even blow open a magnetic structure. The process is slow—unless you jab it with turbulent, rowdy plasma.

The antimatter in their downwash cut straight through flux tubes. Claire carved with her jet, freeing field lines that still snared the worm. The ship rose further, dragging the worm upward.

It's not too heavy, Claire thought. *That science officer said they could come in any size at all. This one is just about right for a small ship to slip through—to where?*

YOU HAVE REMAINING 11.34 MINUTES COOLING TIME—

"Here's your hat—" Claire swept the jet wash over a last, large flux tube. It glistened as annihilation energies burst forth like bonfires, raging in a place already hot beyond imagination. Magnetic knots snarled, exploded. "—What's your hurry?"

The solar coronal arch burst open.

She had sensed these potential energies locked in the peak of the arch, an intuition that came through her hands, from long work with the mag gloves. Craftswoman's knowledge: Find the stressed flux lines. Turn the key.

Then all hell broke loose.

The acceleration slammed her to the floor, despite the water. Below, she saw the vast vault of energy stored in the arch blow out and up, directly below them.

YOU HAVE MADE A SOLAR FLARE!

"And you thought I didn't have a plan."

Claire started to laugh. Slamming into a couch cut it off. She would have broken a shoulder, but the couch was water-logged and soft.

Now the worm was an asset. It repulsed matter, so the upjetting plume blew around it, around *Silver Metal Lugger.* Free of the flux tubes' grip, the wormhole itself accelerated away from the Sun. All very helpful, Claire reflected, but she couldn't enjoy the spectacle—the rattling, surging deck was trying to bounce her off the furniture.

What saved them in the end was their magnetic grapple. It deflected most of the solar flare protons around the ship. Pushed out at a speed of five hundred kilometers per second, they still barely survived baking. But they had the worm.

Still, the scientific officer was not pleased. He came aboard to make this quite clear. His face alone would have been enough.

"You're surely not going to demand *money* for that?" He scowled and nodded toward where *Silver Metal Lugger*'s fields still hung onto the wormhole. Claire had to run a sea-blue plasma discharge behind it so she could see it at all. They were orbiting Mercury, negotiating.

Earthside, panels of experts were arguing with each other; she had heard plenty of it on tightbeam. A negative-mass wormhole would not fall, so it couldn't knife through the Earth's mantle and devour the core.

But a thin ship could fly straight

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into it, overcoming its gravitational repulsion—and come out where? Nobody knew. The worm wasn't spewing mass, so its other end wasn't buried in the middle of a star, or any place obviously dangerous. One of the half-dozen new theories squirting out on tightbeam held that maybe this was a multiply-connected wormhole, with many ends, of both positive and negative mass. In that case, plunging down it could take you to different destinations. A subway system for a galaxy; or a universe.

So: no threat, and plenty of possibilities. Interesting market prospects.

She shrugged. "Have your advocate talk to my advocate."

"It's a unique, natural resource—"

"And it's mine." She grinned. He was lean and muscular and the best man she had seen in weeks. Also the only man she had seen in weeks.

"I can have a team board you, y'know." He towered over her, using the usual ominous male thing.

"I don't think you're that fast."

"What's speed got to do with it?"

"I can always turn off my grapplers." She reached for a switch. "If it's not mine, then I can just let everybody have it."

"Why would you—no, don't!"

It wasn't the right switch, but he didn't know that. "If I release it, the worm takes off—antigravity, sort of."

He blinked. "We could catch it."

"You couldn't even find it. It's dead black." She tapped the switch, letting a malicious smile play on her lips.

"Please don't."

"I need to hear a number. An offer."

His lips compressed until they paled. "The wormhole price, minus your fine?"

Her turn to blink. "What fine? I was on an approved flyby—"

"That solar flare wouldn't have blown for a month. You did a real job on it—the whole magnetic arcade went up at once. People all the way out to the asteroids had to scramble for shelter."

He looked at her steadily and she could not decide whether he was telling the truth. "So their costs—"

"Could run pretty high. Plus advocate fees."

"Exactly." He smiled, ever so slightly.

Erma was trying to tell her something but Claire turned the tiny voice far down, until it buzzed like an irritated insect.

She had endured weeks of a female personality sim in a nasty mood. Quite enough. She needed an antidote. This fellow had the wrong kind of politics, but to let that dictate everything was as dumb as politics itself. Her ship's name was a joke, actually, about long, lonely voyages as an ore hauler. She'd had enough of that, too. And he was tall and muscular.

She smiled. *"Touché.* OK, it's a done deal."

He beamed. "I'll get my team to work—"

"Still, I'd say you need to work on your negotiating skills. Too brassy."

He frowned, but then gave her a grudging grin.

Subtlety had never been her strong suit. "Shall we discuss them—over dinner?" ■

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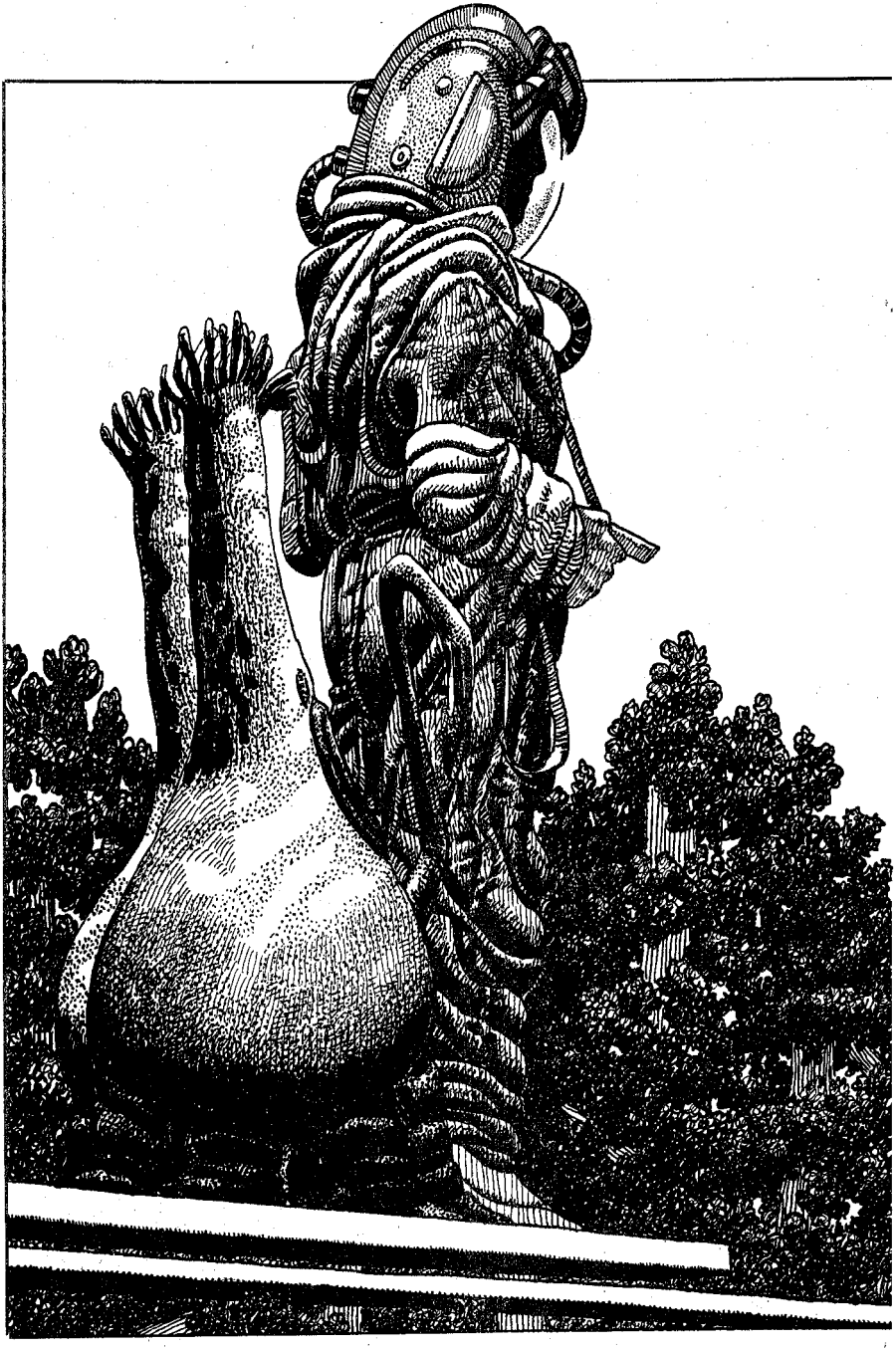

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F. Alexander Brejcha

WITH OTHER EYES

The Travelers gave a whole new meaning to Robert Burns's words: to see not only ourselves, but everything, *as others see it. . . .*

Illustration by Janet Aulisio Dannheiser

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I.

"Excellent, Mitch. You can relax again." Irene Kelly gave me a warm smile and ordered up the lights as she turned off the Ophthalmoscanner she had been testing me with.

She chuckled. "Even if it was a simple procedure, now that you're out of quarantine, I want to thank you for the work. Not much for a surgeon to do on a space station with all the safety procedures in place. But both your eyes are as good as new. You'd never know they've been sitting in a freezer for over two months."

"I would," I grumbled. "My head feels like someone's marching around in it."

"Well, you'll feel some discomfort for a little while as your brain readjusts to normal visual input. But most of it is psychological. The brain has no pain sensors and it just makes you think you're feeling pain because it's bitching about the way you've been switching inputs on it."

I had to smile as I pulled my head out of the scanner. I couldn't blame "it" as she put it. Between having my eyes removed and temporarily replaced with an alternate visual system, and then having my own eyes reimplanted again, my brain had been forced through a lot of changes.

But that and over a month of total blindness had certainly given me a new perspective.

The alien-designed eye-set had given me a strangely rich vision once I had learned to use it, but there had been a surreal coldness to it that had been very disquieting. On the one hand, I had been able to see far into the infra-red and ultra-violet ends of the spectrum, but the greater bandwidth had been at the expense of color nuances in the human-visible spectrum. I was glad I had my own eyes back again. I was finding a new appreciation for the subtle colors in what I had earlier seen as a drab doctor's office. The nurse had removed my bandages several hours ago, but my head had been continuously strapped into the Ophthalmoscanner while all the nerve connections were double-checked, and this was the first time I had been free to just look around.

"Well?" Irene's green eyes were amused as she tilted her head and studied my face. "What's on your mind, Mitch?"

"Assuming I don't have to resign in disgrace and go job hunting, I was just deciding to visit an art museum as soon as I get down on Earth. . . ." I wasn't sure how to explain my reaction. Luckily I didn't have to.

"I understand," Irene said simply and reached down to squeeze my hand. "When you go to that museum, give me a call. And as for resigning: no way! You did all anyone could have. You'll see."

She said it so fiercely that I grinned up at her like some kid in a candy store. And not just because of her support. I was just realizing how beautiful she was . . . how beautiful everything was! The pain was already fading. If only. . . . I tried not to think about the aliens.

Then Irene grabbed her medical bag and patted my arm. "I'm afraid I'll

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have to leave you here. I have another patient to see, and you have a visitor coming. Now that you're no longer my patient, I can't keep the U.N. people out." She reached past me to press some buttons. In response, the machinery around me obediently folded up and withdrew behind various doors and panels in the floor and walls to leave me sitting unfettered in the exam chair.

She paused by the door. "It'll be all right," she repeated softly. "Give me a call after your meeting." Then she waved, and with a last command to the blank wall at the side of her office: "Screen, window mode," left me alone.

The wall shimmered and I found myself looking out on the revolving Earth below us. The image was relayed from the stationary hub of the Hawking space station and displayed in breathtaking beauty on the floor-to-ceiling HoloPanel. But it was a strangely barren image now that only a few service shuttles were visible—now that the aliens were gone.

The aliens.

It dawned on me that I had never even seen the Travelers or their ship with my own eyes. They had already been removed and replaced with the alien-designed eye-set by the time the huge spacecraft had arrived. I cleared my throat and spoke up:

"Screen, data mode. Display window view of Traveler ship prior to departure." The wall obediently changed images and suddenly an immense deep-space vessel seemed to hang a few kilometers away. Ironically, it did not look all that different than I remembered.

The body of the rotating ship consisted of a slender triangular shaft that was nearly a kilometer long and thirty meters in diameter. The central body was capped by a three-sided and truncated pyramid that faced me. The instrument-dotted, thirty-meter-wide base of the pyramid was pitted and scarred in contrast to the shiny sides, which narrowed until they merged with a circular plate in the front end of the central shaft. The plate and bow-unit were counter-rotating to be stationary relative to the station.

Just aft of the bow were three enormous pyramidal pods about two hundred meters tall that extended base out from the central shaft. These were rotating to provide maximum gravity at their triangular two-hundred-meter bases now that the ship was at rest. Except for the same patina of age and travel that marred the bow of the ship, each of the huge rotating pyramids was smooth and unmarked, fusing seamlessly with the central shaft about thirty meters from where their tips would have been. At the far end of the long central shaft loomed a large dish, nearly half a kilometer in diameter, that faced away from us. The circular shape of the dish was in jarring contrast to the angular shapes and straight lines of the rest of the ship.

It was quite a different-looking ship than shown by photos broadcast by long-range observatories. Those had shown the ship decelerating stern first at a constant 1.2 gravities, the large pyramids lying parallel to the sides of the central shaft so that decel-

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eration supplied the gravity rotation now provided. The tips of the pyramids had been pushed out by some sort of extension rod arrangement.

"Screen, window mode," I called and watched the alien ship disappear . . . gone from the screen, gone from the station. . . .

Gone.

Only the amazing recordings I had brought back with me remained as a legacy of the incredible visitors who were now forever beyond our reach. Those, and the memories of a visit I would never forget. . . .

II.

"Well, Mitch. You're just about there."

The perennially irreverent and cheerful U.N. Contact Team coordinator who was monitoring me sounded more than a little envious over the audio link. Personally, I wished that Babek Beedassy was along for the ride. He had become a good friend in the months since I had first made contact. He had also helped me through the rough times while I had been adjusting to the alien eye-set. I had been using the device for almost two months, but I had only recently learned to really "see" with it. I didn't know how the device worked and I didn't want to know. A cross-section of doctors, physicists, and nanotechnologists had raved about the incredible design of the eye-set, but even with all of their testimonials I had been afraid to try it. But I had had no choice. The Travelers had demanded that I use their eye-set to see with when I came onboard their ship for my visit. For some reason they had insisted on that. They had repeatedly made reference to my being invited as a "witness" to something—something that required my seeing things the same way they did. But they had refused to elaborate, and I had had to make a choice between losing my place in the history records and temporarily losing my own eyes.

Temporarily losing my eyes!

It had taken a lot of sleepless nights for me to accept that. The thoughts of my eyes being removed and replaced with a device designed by aliens had scared the shit out of me—even if the best neurologists in the world had put together the physiological data the aliens had requested. But what if something went wrong during the operation? Or what if the doctors couldn't give me my own eyes back after I was finished my "witnessing"? I had really not been ready to risk another major shock to my life—not so soon after my wife Ellen's death.

But I had eventually surrendered to a combination of peer pressure and reluctant curiosity. And after an extremely frustrating month of fumbling around in darkness, and then weeks of living in a polychromatic Escher-like nightmare environment, I had finally learned to "see" again.

And now I was at the point of no return.

Ahead of me, the rotating habitat pods loomed over me like a giant's arms ready to swat me out of existence if I made one wrong move. And I had better not! As the SETI astronomer who had originally decoded the Travelers's intricately hidden message

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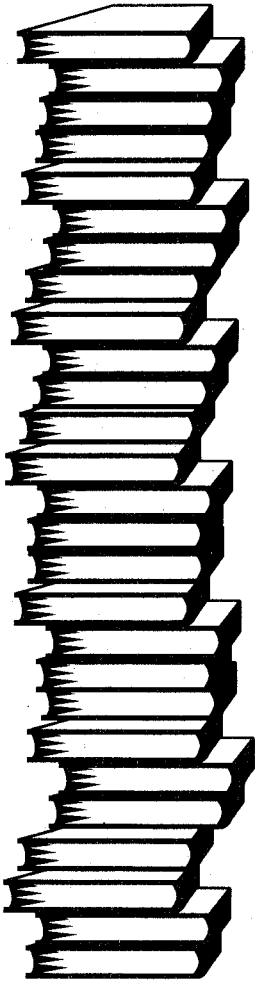

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MYAA6

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and later established contact, I had been invited as Earth's sole representative—and the eyes of the world were looking over my shoulder through a mini-cam mounted on the shoulder of my atmosphere suit.

I was getting more and more worried about possibly screwing up my meeting with the aliens.

But at least I would soon find out what they looked like. Using the control codes we had sent them, they were piloting my shuttle remotely and before I knew it I found myself closing in on the stationary bow-pyramid where a large triangular opening gaped. Moving smoothly, the shuttle was brought into a large cargo bay to hang several feet over the deck. Then there was a whisper of metal against metal as unseen grapples reached up to snag the bottom of the craft to pull it down with a solid, echoing thunk. As the sound faded, the wide doors behind me slowly closed and I felt my audio connection with Babek cut off at the same instant. All at once I felt monumentally alone. The private audio link between us had had its own low-level static that had been reassuring even when Babek had been silent, but now even that was gone. I could only assume that the monitoring camera signal had also been cut off. Now I had to trust that the computer I wore was recording the signal from the minicam, and also the direct feed from my eye-set that was being recorded as a back-up.

Tempting memories of my nice, snug, and boring desk job at the rebuilt and upgraded Arecibo SETI site swirled through my mind and I felt an intense longing to be back there sifting safe and anonymous numbers. It had been a job where I had been able to hide myself from reality—and memories of Ellen. But like the cat that had been killed by its curiosity, I had been teased and tempted by a mystery that had eventually condemned me to be at the center of world attention.

It had all started with some signals in the 1.42 and 1.65 gigahertz range I had detected while working at Arecibo. I had focused on those ranges since the hydrogen and hydroxyl bandwidths seemed like good potential sign posts for any alien transmissions. I had found the hint of a pattern, but I had been unable to do anything with it until I had accidentally come across some other strange signals picked up by the Hawking Station Space Observatory. It had been when comparing the three sets of signals that I had found that anomalies at around 15 GHz from Hawking echoed lower frequency ones from Arecibo. The higher frequency transmission had not been picked up on Earth because the atmosphere interfered with anything over 10 GHz.

Then, as I had coordinated the signals, a clear pattern had emerged and I had ironically found myself forced to call on my memories of Ellen to solve what was obviously an encrypted message. Ellen's specialty had been linguistics, and in order to keep up with her I had made a hobby of language puzzles. With the alien message, I had found myself studying the ultimate language puzzle and deciphering it had gradually grown to a

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near obsession.

It had taken months of number-crunching, but I had finally pieced together the complete Traveler message and decoded it. My guess had been that it had been split up as a test of our problem-solving skills—and to see if we were a space-faring race, since part of the signal had only been detectable to space-based observatories.

And now here I was; about to pay the price for my "brilliance," as a correspondent for *The SETI Explorer* had put it.

As I looked out the window at the starkly bare cargo bay, I noticed a slight hazing of my vision that revealed that air of some sort was being pumped back in. After a seeming eternity, external sensors indicated that the higher than Earth-norm air pressure I had been told to expect was holding steady, so I took air samples as instructed while I waited. Then the signal came for me to exit. Swallowing, I closed my helmet and switched to suit-air as I muttered a quiet prayer and cycled through the airlock.

I stepped out of the shuttle carefully and relaxed as my magnetic boots held onto the plain and unmarked deck. I had also wondered about the lack of decontamination procedures, but when I had passed on questions about it from nervous United Nations Science Team staffers, a curt: "Not necessary, you are no source of contamination," had been the Traveler's only response. And all along, they had deftly sidestepped my every attempt to get pictures of them or more information. "You will see me when you see as I do," had been their persistent response.

And now I was doing just that, and getting a headache from it.

Two Travelers emerged from a large triangular doorway across the bay, and I was reminded of something my father had shown me. He had pulled out a strangely colored poster mounted on cardboard that only came to real vivid life when illuminated by an ultra-violet light. Just like that poster, the aliens had a surreal shimmering coloring to them that seemed appropriate considering how they looked.

But I had lost a mental bet with myself. Based on the preponderance of triangles, I had expected some kind of three-legged critter like in a couple of classic science fiction books. Instead, I found myself facing a pair of cosmic Shmoos. Dad had also shown me old Li'l Abner comic strips by a cartoonist named Al Capp, and on first glance the Travelers looked eerily like his innocuous creation.

They were only around two-thirds my height and had very stable-looking and bulbous lower bodies, with six stubby legs and broad flat feet with multiple fringed toes. A single folding arm extended up from the lower front of the body, tipped with tentacle-like "fingers." The "hand" hung down in front, reminding me of a one-armed praying mantis. The apparently naked body narrowed about halfway up and the long neck extended up to a top crowned with a bush of short cilia-like hairs. In the center of the body, there was a large round organ

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that looked like the woofer of an old-fashioned stereo system. Over that, there were two large and vacant-looking eyes placed at about eleven o'clock and one o'clock. Diagonally aligned slit pupils that reminded me of a cat's eyes flexed in width as they inspected me.

Examining me in different frequency ranges? I wondered as I swallowed. There was something unsettling in that relentless stare, interrupted occasionally by the swipe of nictitating membranes.

Not a pair of Shmoos at all, I decided. Between the seemingly predatory hand and stare, these were not at all like Al Capp's benign beings. I heard the environmental control of my suit laboring to cool me and remove new sweat added to the perspiration from the constricting suit and warm ambient temperature.

But it was time to say hello.

Together with my Traveler counterpart, I had painstakingly worked out a compromise language based on the Traveler tongue. For some reason they had been unwilling to communicate as we did. The exact reason had been intentionally vague on their part, but it should have been possible since their vocal range extended from an inaudible 30,000 hertz to a literally tactile 5 hertz.

I tried not to be rude as I studied that round organ on their bodies again. I wondered if it was an organic speaker to push out those low frequencies.

But because of their restrictions, we had come up with a compromise language which while usable, was limited and dependent on a sophisticated parser and fill-phrases to simulate a more normal conversation. There were major nuances of their language that we were totally missing because physical sensations from the low frequency signals played a role in their communication. Still, as basic as our translation program was, it was functional. And it had allowed us to talk once the Travelers had come close enough for the radio signal's time lag to be bearable.

I reached for the paperback-book-sized Braille Pad strapped to my suit and composed my thoughts. Without taking my eyes off the Travelers, I felt out the locations of the six character buttons and space bar of the small computer. They were a hell of a lot easier to handle than a full keyboard—especially by feel—and I was glad I had learned to use it. The Braille Pad had been my work tool while I had been a blind and frustrated student trying to use my new eyes. And once I had learned to compose the letter and command chords, I had been amazed by the compact size and ease of use of the small device.

Speech recognition, as good as it was, had been vetoed because of fear that homonym error might confuse things in real-time conversation. So, it was time to let my fingers do the talking. I was glad that the eyes of the world were off me for the moment because this was another historic moment like Neil Armstrong's first steps on the Moon, and my words needed to be at least equal to his immortal "One small step for a man, one giant leap for mankind." Fortunately the

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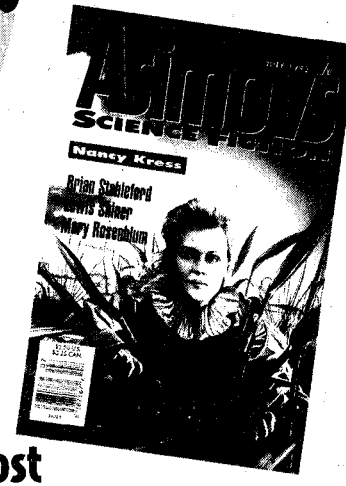

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MYAS4

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U.N. protocol people had taken that burden off my shoulders and I reached down to type:

"I greet you on behalf of all humanity in the hope that these will be but the first words of a long dialogue."

The speaker on my braille pad let out a combined rumble and squeal. A moment later a squeal came from the Traveler on the right and a female voice in my ear announced an abrupt: "Follow me."

My computer assigned a random "voice" to each different speech input and I wondered again about Traveler genders. I could see no sign of sexual organs on their naked bodies, and no difference between them. But there was no time to think about it because they spun in unison with no acknowledgement of my greeting or of "the moment." Instead, they headed back to the far wall of the hold without another word as I hurried to keep up.

The large triangular doorway opened as we approached and I smiled. The shape was beginning to make sense now that I had seen what the Travelers looked like: they were also tiny on top and wide on the base.

The entrance turned out to be the first in a pair of heavy doors leading into a large room about six by ten meters in floor area. Suspecting what it was, I grabbed for the door frame to hold on since I didn't have the lower body stability of the Travelers. Sure enough, without warning I found myself lurching to the side as my feet tried to pull away from me. We were in a spin coupler, which meant we were heading out into one of the giant habitat pyramids.

I felt like a little kid unwrapping his first Christmas present. What would I find?

Before long, my feet stopped trying to escape from me and I was able to let go. The Travelers had been oblivious to my imbalance, and as the far doorway opened, they led the way out into a large triangular room where I found myself drifting up into the air, my magnetic boots no longer gripping. The room had three equidistant triangular corridors about four meters in diameter extending out, one in each wall.

My hosts continued to ignore me and used fine guide-wires crossing the room to rotate and float gracefully towards the right. Then they pushed themselves feet first into one of the corridors and I finally got a look at their "feet" and saw their small metallic sandals.

Feeling light-headed, I followed the Travelers's example nervously, only to find that the corridor was apparently an elevator, because my feet quickly touched floor and stuck there as they found magnetic grounding again. As soon as I snapped into place next to the Travelers, we began to fall outward.

It felt strange to be so close to my bizarre hosts, but after we had dropped a few meters I forgot all about them. I had just discovered that our "elevator" was nothing more than a platform with guide-rails. The rails kept it on track as we emerged into an open space and dropped rapidly out towards a wild organic jungle that occupied the inside of the pyramid.

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With all the open air around me, I felt almost as nauseated and disoriented as on my first shuttle trip. I backed towards the center of the platform and spread my feet. Compounding the effect of the dizzying view around us was a familiar sensation: the mild disorientation one felt in moving from hub to rim on the station because of Coriolis force and change in gravity. I couldn't help myself but swallowed hard as I squeezed my eyes shut.

But within minutes I grew aware of a welcome feeling: increasing pressure against the soles of my feet as we moved out into the pyramid. Steadied by the return of gravity and prompted by curiosity, I opened my eyes and stared as we plunged into the tree tops.

I was fascinated by the organic tapestry weaving itself through the air around us. An invisible barrier kept the lush growth several meters from the path of our lift. Apparently the top of this pyramid—and also the others? I wondered—was reserved for vegetation that grew almost unchecked in the low gravity this high up. I also noticed a fine network of wires laced through the branches and realized that they were there to support the jungle during acceleration and deceleration since the entire pyramid would be under gravity during those times.

Edging forward carefully, I moved closer to the edge and tried to spot the floor of the jungle below us. But try as I might, I could only see increasingly dense and interwoven branches that grew more disciplined the farther we dropped from the central shaft of the ship. I was starting to wonder if there was anything in this pod but forest. I tried to spot any movement, curious to see if there would be any animal life up here, and after a moment I was rewarded.

A swarm of tiny shapes were making flying leaps from branch to branch. They had small glistening bodies shaped a little like a pair of dumb-bells, large antennae-like fronds on the top of the front body bulge, and an indeterminate number of legs.

Traveler monkeys, I decided and looked around, wondering how long the ship had been traveling. Despite the size of the ship and the elaborate ecosystem, I doubted that it was a generation ship. Maybe the other pyramids held cryo-chambers, and automatic systems awakened a crew when necessary?

Then a sudden shift in movement interrupted me and I realized that our ride was over. The platform had landed on top of a metal pad in the middle of the jungle. There were no buildings, paths or artificial structures in sight, other than our elevator platform and the guide-rails disappearing up to merge with the shaft we had come out of. I was surprised that the gravity did not seem much higher than Earth norm and I realized there had to be more to the pod beneath me given the speed of rotation. Support infra-structure for the jungle? Or living quarters?

An abrupt squeal interrupted, and then I heard: "Follow," again as my bowling-pin escorts walked off the metal platform. Somehow, they had

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managed to step right out of their magnetic shoes as they walked onto the gently rolling "grass" that covered the naturally contoured ground between massive one-meter-thick tree trunks. As I knelt to inspect the growth, I saw that the tubular stalks were crowned with a fine network of fibers that seemed to flex and reach for the light as my sharply defined shadow blocked the powerful but diffused illumination from above.

The Travelers were oblivious to my curiosity and I had to hurry to catch up as they took off. I was glad they were not paying attention since I almost fell flat on my face as I stumbled over the rough, natural terrain. Years of academia, laboratory isolation, and then months on the space station, had made me forget what the "outdoors" was like. As I caught up with my escort, I mentally retraced our movements and decided that we were heading for the leading edge of the pyramid—literally an edge, given the orientation of the three pods. It took several minutes of weaving our way through the dense . . . forest—down here the growth was much more disciplined than above—but before too long we broke out into a large clearing that took my breath away.

The walls had been closing in on us as we approached the front of the pyramid, but where we should have faced a sharp corner, I saw a flat, triangular wall about twenty meters high at its peak that filled in the front corner of this pod.

The location of the control room and quarters for other ship's functions?

But what really made me stop and stare was the way the wall was decorated. To my new eyes, it was a sight to see. The whole surface was a giant work of art combining different textures, colors, and shapes. A battery of floodlights illuminated it and there was a reverence to my guides as they stopped and seemed to sink closer to the ground. From the way I had to concentrate much harder to focus on the rich details, I knew instinctively that it would not look the same to normal vision. There were probably paints and materials used that would blur indistinctly together when viewed in the human visual range of 4,000 to 7,000 angstroms.

Now I started to understand why the Travelers had insisted on my using their "eyes."

My escorts had moved aside to give me a good view and I had the distinct feeling that they were watching me very carefully as I approached the wall. But I soon forgot them because the closer I got, the more detail revealed itself. I hoped the camera was working properly and I made sure to turn every which way to record as much as possible.

As I studied the wall I knew I didn't disappoint my expectant hosts, because I was mesmerized.

It was actually a collection of triangular picture frames, alternating vertical orientation to fill the large wall. I had focused immediately on the very top picture, which depicted a large number of spaceships like the one we were in departing from a planet orbiting an angry-looking star. But then I realized that I was looking at the

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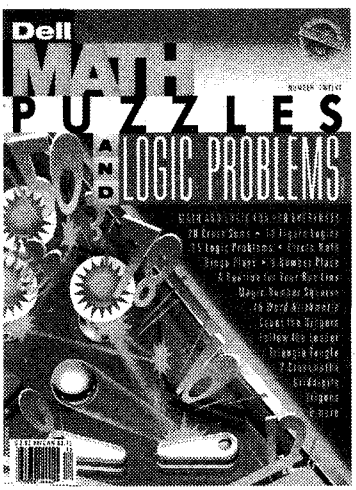

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pictures in the wrong order. I had just noticed the bottom right frame and it was clear that they were ordered from bottom to top, right to left.

The picture I had been looking at was the final in the series. I wondered whether it was the beginning of exploration, or an exodus; a flight from a dying star? I looked back up at the frame. Unlike the other highly realistic images, the star in that final picture seemed almost abstract. It looked too menacing to be real.

But I disciplined myself and went back to the beginning.

The first picture showed a roiling ocean that seemed to cover nearly an entire planet. Moving over to the next pictures, I saw the ocean begin to fill up, first with tiny, unidentifiable shapes, and then with small jellyfish-like creatures that swam in pairs. Gradually, the jellyfish grew in size and complexity, and by the fourth frame, I could see the beginnings of a familiar-looking round organ in the middle of the body.

I glanced over at my escort as I saw that the jellyfish always swam in pairs. Now the single arm made more sense.

And given the way sound played a much more important part in Traveler communication, I wondered if the early Travelers used a form of sonar, like dolphins, to see, navigate, and communicate. Given the greater density of their atmosphere, it was easy to see where that would continue to play an important role after they left the water.

Gradually, the Travelers grew larger and lost their earlier ethereal look. The oceans were shrinking, too. Comparing pictures, I realized that the sun was growing larger in the pictures. Only in small increments, but it was noticeable. Apparently that was the impetus for a migration to the land, because one of the next frames showed denser Travelers making their first forays onto land, struggling to move as they were propelled by dozens of thick tentacles.

It was easy to see why they were migrating. Increasing mineral concentrations in the water, less living space, less food and so on: all classic evolutionary forces.

Subsequent panels showed various stages in Traveler evolution, social and technical. One thing I found interesting was that it was not until after the beginning of an industrial age that any type of buildings appeared. With virtually no axial tilt, there were no real seasons, and shelter from rain was apparently not a concern. But with the advent of scientific experimentation in chemistry and metallurgy, buildings began to appear. Almost exclusively to house laboratories at first, it seemed. But even after population density increased, the dwellings I saw depicted were minimal and very open to the elements.

The natural environment around me started to make more sense. The Travelers were obviously more comfortable this way.

I turned back to the wall while the Travelers waited patiently. . . . No: just waiting. I would have to be careful not to assume anything.

Water still covered large parts of the planet, through islands and proto-

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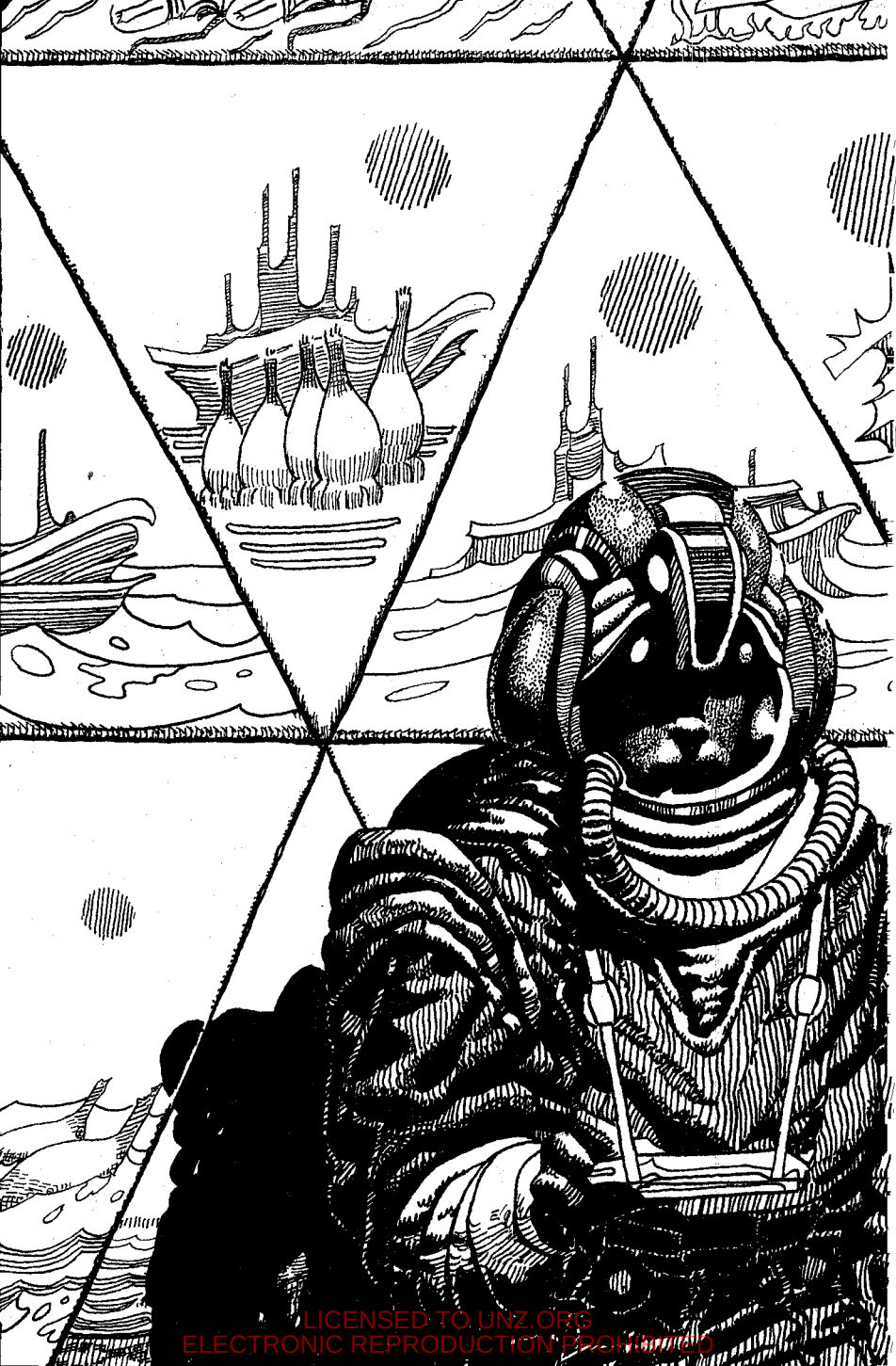

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continents were more and more in evidence. But the Travelers never ventured far from the water. The first vehicles I saw evidence of were ships, and commerce and transportation seemed to be exclusively by water. Then I saw them return to the depths of the ocean, but this time in diving suits and submarines.

Skipping a few frames, I saw the sun continue to grow and the oceans to shrink. Now the Travelers were turning their attentions upwards. Telescopes, at first, then crude exploratory rockets, and finally, the first Travelers in space. More and more telescopes appeared, evenly divided between examining the sun and searching deep space. And simultaneous with their first steps into space, huge floating dishes appeared on the seas and on the highest land areas available. Radio-astronomical observatories to scan the skies, I presumed.

They must have realized that something was going wrong with their sun, and they were probably also trying to see if there was anyone else out in the Universe. I thought about Arecibo and smiled. Until my eyes skipped up to that final frame momentarily and the finality of what I was seeing sank in.

I looked down soberly.

The succeeding frames showed an increasing focus on space, with larger and more complex spaceships reaching out to plant bases on the two moons, and then on larger asteroid bodies scattered through the system. There were no other planets to colonize. Then a framework appeared in space: a monumental manufacturing facility floating at what had to be one of their Lagrange points. The resources of the whole world were apparently focused on it, and construction began on a vast fleet of ships such as the one we were in. At the same time, I saw the world change frame by frame as the oceans continued to recede.

The final picture was the one I had focused on first, where the exodus from the Travelers's home world had begun, and my eyes returned there reluctantly. But with my new perspective, I noticed something else.

I had thought that the last dozen frames were decorated with a border along the base, but I realized now that there was a much more somber reason for the detailing. Focusing until my eyes hurt—or were those tears trying to come out but finding no place to go?—I saw that the border decorations consisted of long rows of tiny stylized Travelers pairs. But panel by panel, approaching the final picture on the top, the number of rows diminished. From twelve rows of tiny figures on the first panel to use the population census, the final one had only a fraction of a single line.

My chest was hurting in a way I had not felt since Ellen's death as I realized that the final frame probably was showing an exodus. Despite the large number of ships launched, only a tiny percentage of the population survived and they must have all left, scattering in all different directions to maximize their chances of finding a new home.

I wondered how many had been left at the end. And I tried to imagine

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what it must have been like for them, living their whole lives with that sun overhead, the radiation getting stronger and stronger as it baked away the ocean and the life around them.

But at least now I knew why they had come: they had to be looking for a new home.

I turned around. The two Travelers were standing motionless, bent back slightly, and I had the impression they were as absorbed by the wall as I had been. It was almost as if they had forgotten all about me. I wondered if these two knew that they had come to an unusable system. Earth was occupied and had a hostile atmosphere, Venus was too hot even for them, and Mars was far too cold and low gravity.

Restraining a morbid laugh, I reached for my Braille Pad to type: "Take me to your leaders."

But the Travelers did not respond immediately. They were still frozen in place, bent back as if they were also staring at the same final panel, and I had to repeat myself before they turned back to me.

A long squeal, and then the male voice of our previously silent escort spoke, seemingly ignoring me.

"My birth, my life, my death."

"My Journey must end," the other added.

Then there was a rapid interchange that was not translated until the female voice ordered me to follow as the two quickly passed me and headed towards the mural wall. They did not even slow as they approached it and a large triangular section retreated a few centimeters and then silently slid aside just in time.

They didn't even look back at me, and I hurried after them with a suspicious glance at the door as I hunched down to enter the claustrophobic hallway. But as I followed, I thought about their fascination with the wall behind us. What would it be like to face a constant reminder of a doomed history like that?

Then I remembered my eighth birthday.

I had been visiting my aunt in Spokane when I had been admitted for an emergency appendectomy. As a surprise, my parents and two sisters had taken a flight up from L.A. to visit me, but one engine of the plane had exploded on landing to send the plane spinning out of control into the runway. Everyone on board had been instantly killed. I had spent the next ten years being shuttled from relative to relative, afraid to get comfortable or to love anyone for fear of losing them. And every time I had seen a classmate get picked up by his or her parents, it had been a reminder of what I didn't have and of how uncertain my future was.

Maybe I had an inkling of what the Travelers felt, after all?

Then the walls opened up and I found myself the focus of attention from six new Travelers perched in pairs on odd, low stools around the edges of a large room. In the middle was a raised platform with two slightly more elaborate stools occupied by another pair of Travelers who wore heavy and colorful capes. As I entered, they stood up and the one on the right let out a rapid run of

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speech as it faced the others.

Whatever was said wasn't translated but all the other Travelers immediately got up and filed out, leaving the three of us alone in the room. As the door slid shut, the remaining Travelers spoke in chorus.

"I guide this vessel."

Then the one on the left added: "This entity is. . . ." An untranslated squeal I tagged as "One," and which was the same as the unseen speaker in the cargo bay. "And—"

"—And this entity is. . . ." The one on the right finished with a different squeal I tagged as "Two." The numerical designations would be spoken now, whenever the Traveler names were used.

I thought quickly and reached down to type: "This entity is Mitchell, and I am here to see and to learn."

"You are the Witness," One and Two said simultaneously.

"Witness to what?" I asked.

"To my Journey," the chorus responded, reminding me of the incongruity of individual names given their indifference of personal pronouns. Maybe the partial collectivization was due to the increasing focus on species rather than individual survival towards the end? And I wondered about the link that had to connect them so they could speak in unison.

I was continually being reminded of how little I knew about them, other than what I had seen in the brief history mural outside. And now I also wanted to know more about their "Journey." But as expected, my question about that was ignored.

"You are here to see and learn about me," was the ironic response I got and I felt like screaming as they added: "An environmental chamber had been prepared from your directions. It had been sterilized and filled with gases compositionally equivalent to your sea-level atmosphere. There you will be witness." They turned and headed for the right wall, part of which also slid aside obligingly for them, and remained open for me as a peremptory and familiar: "Follow me," drifted back.

I was getting a little annoyed by the silent treatment, and as we walked, I reached down to type.

"I can see from your history mural that you have probably been searching for a new home for a long time. I wanted to ask why I have only seen a few of you. Is this a sleeper ship? Is the rest of your crew in suspended animation?" From what we had seen of their approach, the Traveler ship had no fancy hyperdrive or any other such science fiction means of propulsion.

But there was no reaction to my questions as we hurried along. There was another possibility I didn't want to consider. Given the precipitous decline in their population, maybe these were all the Travelers left? It would explain their urgency in wanting to pass on information about themselves, and their lack of curiosity about us.

I tried again. "What is in the other two pods like this one?"

"Those who lived," was the immediate answer from ahead of me. But neither elaborated.

"Those who lived"? Did that mean

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they were dead? Or just asleep? I didn't have a chance to ask which, because my escorts suddenly stopped; right in front of an obviously jury-rigged airlock.

"Enter," number One commanded as the outer airlock door opened. No explanation, no comments, just an abrupt command. But I was too curious to be irritated. This was the reason I was here.

Drawing a deep, sweat-scented breath, I stepped in and crossed my fingers.

As the door closed behind me, my suit started billowing wildly as the air pressure dropped. I was briefly blasted with heat, a strange intense light, and then a swirling fog of faintly luminescent gas. Then my suit finally settled down and the inside door opened to reveal a large room with a wide display panel taking up most of the far wall. An uncomfortable-looking bed had been added over in one corner to the left, right next to a closed rectangular doorway that looked strangely out of place after all the triangular openings I had passed through.

"Sanitary facilities are in the next room as specified," a disembodied voice that sounded like number One announced as I entered the room and the airlock door closed behind me. "Your suit and these chambers have been sterilized since you fear contamination."

I had a momentary vision of some alien form of Montezuma's revenge hitting me at an indelicate moment and then shrugged it off. Even if the chamber had not been sterilized, I doubted alien germs would find my system very hospitable. I reached up gingerly to undo the release catches and cracked the seal to lift my helmet. Pulling my head free, I wrinkled my nose as the neck seal got caught on it, ripe with the sweaty smell of damp padding. Feeling my pulse race a bit, I breathed out and then drew in the room air tentatively to find myself inhaling scentlessly clean and cool air.

I relaxed and turned off the now needless air regulator for my suit and took some cleansing breaths to get rid of the taste of canned air. Much better.

A noise caught my attention and I turned to see a panel in the right wall slide open to reveal a spare air canister.

"This is from your craft," number Two's disembodied voice explained from all around us. "Exchange it and place the used one here. It will be recharged for use."

"Why am I here?" I tried again. I felt silly looking up as I switched my tank, but it was as good a direction as any. And at least this room had a higher ceiling.

"To learn where your eyes can see better," came number One's immediate answer. Apparently One and Two were taking turns speaking. Then the strange wall panel I had noted before was alive all at once with images of incredible depth and clarity. Traveler display technology obviously took full advantage of their sense of vision.

"Will your recording system work at higher than real time speeds as you stated?" our hosts asked in unison.

I nodded. "Up to about thirty times

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normal speed given a high resolution image," I typed.

I debated getting out of my suit to get comfortable, but before I could suggest it, my hosts spoke up again.

"Focus on the display. Sit down in front of the screen."

I noticed the low stools that seemed to be built into the floor in front of the screen. There were six of them arranged in pairs in a semi-circle. I squatted awkwardly on a central one, feeling like an intruder in a kindergarten.

Without warning, the screen shimmered and I found myself looking at a vivid image of the ocean in the first frames on the wall outside. As I watched, the picture shifted and alternated with teasingly brief images of close-ups within the water. Accompanying the fluid flow of images was a rapid, high-pitched squeal which, when slowed down, would probably prove to be a narrator's voice. I restrained a bitter smile as I realized that I watching the Traveler equivalent of a PBS documentary.

A very gloomy documentary.

As I sat looking at the featureless blur of the screen but not watching—I was trusting my computer to record both sets of input—I found my mind drifting back dangerously close to the zombie-like depression I had lived in for much of the three years since my wife's death. My chance finding of the Traveler signal eight months earlier, and all the subsequent work, had begun to penetrate the fog to pull me out of my depression . . . until now.

Confronted by members of a dying species who had scattered across the Universe to flee a star in its death throes, I felt a whole new level of gloom threatening me as I sat there recording their history and passing time without being aware of it.

Then the subliminal squealing stopped. The screen stabilized with a vivid image similar to one of the panels in the mural: during their transformation from aquatic to land-dwelling beings. Then the display went blank. I decided that the wall outside was an abridged Traveler history text and that I had been shown it first so I would understand the importance of the full classroom course I was being exposed to now.

My muscles and my bladder were all screaming for relief, and I stood up to stretch, grateful for the sanitary functions of the suit. Glancing at my watch, I realized in amazement that I had been sitting motionless for almost four hours and I wondered what was next.

My answer came as the same panel that had provided my fresh air canister slid open again. But this time, the compartment behind it was piled high with supply containers from the shuttle.

"Eat and sleep," came a new order. "When you are ready for the next viewing, tell me."

Relieved, I turned off the camera and computer and then stripped off my suit and ducked into the bathroom. Luckily the layout was familiar and I immediately hopped in the shower, and then dried off and put on a fresh jumper. Then, heeding the rumbling of my stomach, I sorted

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through the pressure cases. Among the insulated food carriers, I found a small one I didn't recognize and I opened it to find two dewy squeeze bottles of ice-cold beer and a note from Babek:

"Just thought you might need this by now. Enjoy."

I chuckled and raised a bottle in a salute. "I know you can't hear me, but thanks."

The beer did a lot to ease my digestion of the tasteless rehydrated low-residue rations and I almost enjoyed my meal. But then everything caught up to me and I stretched out on the bed for a nap, feeling the day's accumulated tensions drain out of me.

Six hours later, I strapped on my computer and camera again and let my hosts know that I was ready to go. I also warned them that I might have to pause my viewing to go to the bathroom, feeling a perverse satisfaction from gaining a measure of control. Until that moment, I had been forced to follow their schedule. But between refusing to call the Travelers immediately on waking and insisting on bathroom breaks, I felt relaxed and ready to go.

The next thirty-six hours were split between naps, meals, and bathroom breaks, each session bringing me closer to that final tragic frame I had seen. But frustratingly enough, every effort to just talk to my single-minded hosts met with stoic silence.

Finally, I found myself looking at a vivid frozen frame that was a virtual duplicate of the exodus picture out on the wall mural. The roiling sun dominating the picture actually did look every bit as daunting as the sculpture and I realized that the Travelers were probably living their lives in shielded suits and homes towards the end. It made the forest outside that much more understandable: a defiant return to better times; probably using carefully nurtured plants grown in a shielded environment.

I got up to stretch, curious about what would be next, but then I froze as the screen came to life again. A different squeal took over the narrating duties as new, speeded-up images were displayed. I sat down, my heart racing as I caught glimpses of various passing star fields and planetary bodies. I hoped like hell my computer was recording properly, because this had to be the Travelers's journey—which meant we could backtrack to their home system. I was afraid to move until it ended. But after about an hour, the screen went blank and a familiar chorus announced:

"The witnessing of history is over. Put on your suit and prepare to leave this chamber and return to your ship."

I looked up, getting angry. "That's it? Come look at your pictures and then out the door? What about our history? Information about us. You refused our offers of information before, but now that we have seen yours—"

"The witnessing of history is over," number One interrupted, the computer voice's normally natural inflections somehow hostile and final.

It was the same reaction I had met before.

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With half a dozen U.N. representatives and world leaders panting down my neck and dictating to me, I had made countless requests for more meetings, personnel exchanges, more information, and so on, ad nauseam. But the Travelers had put an end to all that by stating plainly that:

"Any further communications unrelated to making preparations for one visit by the Witness will result in my leaving without further contact. I am not interested in you." Period . . . end of transmission.

There had not been much to add to that.

Still, as frustrating as it had been, I had loved the way political pretensions had been deflated by the Travelers's massive disinterest in humanity.

But apparently I had been wrong to hope that their attitude would change once they had had their "witness." Disappointed, I turned off the computer, changed into my undersuit, and reconnected all my plumbing. Then I climbed back into my flushed-out atmosphere suit and grabbed my helmet with a sigh. When I put it on, I wrinkled my nose as stale canned air hissed in once again. It reminded me that I would be in quarantine when I returned to the station, since I had breathed air here—even if in a "sterile" room with pure gases.

I couldn't believe that it was all over like this.

Then I remembered that the Travelers had said my witnessing would take almost a week, and I had only been a little over two days. A slight trace of hope remained that there was more to my trip as I headed for the door. The inner airlock door opened as I approached it, and I was quickly cycled through and back out to face number One and number Two. They barely looked at me as they efficiently herded me down a new corridor to return to the doorway that opened out to the jungle.

This time I was in for a surprise.

A huge crowd of Travelers had gathered outside. They seemed to fill the open field in front of the sculpture wall, only leaving a narrow corridor towards the elevator platform. As I followed my guides past the other aliens, their massed attention was overwhelming and I looked around me in amazement. Apparently I had been wrong about their dying out. I lost count of the bobbing and weaving figures surrounding me like a forest of old punching clowns. But as I stumbled onto the elevator I realized that something was wrong. There was a variance in shape and color among many in the watching rows that seemed at odds with the virtually identical appearance of the first ten Travelers I had met. A queasy feeling unrelated to the rising elevator started twisting in my stomach.

Then we stopped about ten meters up in the air. Looking down from where we were was an odd experience. Because of all the foliage, I could only see the Travelers scattered around the base of the elevator, but somehow I knew that I was the center of attention of the whole ship.

My escorts moved to the edge of the platform, blithely perched millimeters from a fall, and they faced in opposite directions to speak in ring-

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ing squeals that echoed all around.

"This is the Witness. My Journey had purpose."

Then the elevator resumed its rise.

Number One and number Two continued to be conversational chatterboxes as I wondered what was next. I was getting more and more pissed off as they ignored my every attempt to find out what else they had planned. But as I was led up to the shuttle, I saw that something had been strapped to the roof. When I stretched to examine it, I saw that it was a smaller version of the display in the room I had just left.

"What's this for?" I asked.

"You will signal us when you are back on your station and have placed the display for viewing," number One said abruptly. "It is self-powered," number Two continued, "and will receive my signal so you may complete the Witnessing." Then they turned and headed back to the spin-coupler, leaving me to stare after them with an open mouth.

That did it.

The camera and computer were on again but I didn't care. I moved after them stabbing at my keyboard. "No. I am not leaving." I jammed down the send chord, wishing I had a way of yelling with the Braille Pad. It's no fun throwing a temper tantrum when you have to do it in a polite conversational tone. All of a sudden, resentments were boiling over and I didn't give a damn about what Babek and his bosses might do to me when I got back to the station. I was alone with the Travelers right now and it didn't matter that my every word and gesture was being recorded for posterity. My morbid imagination had conspired to give me a nasty suspicion that I needed to put to rest before I went any further.

"Why?" Number Two asked as the pair froze and turned in unison.

"Because you owe me! I have been your patient servant for months. I allowed myself to be operated on, I suffered temporary blindness and the risk of never getting my own vision back, and finally, I came here as your patient 'witness.' And now you're trying to send me on my way without the courtesy of telling me why you have been so insistent on showing us your history! Or why you don't care about ours."

I remembered something else. "Take me back to the history mural, and have a display screen set up for me. I want to see something. Then, I will leave."

Number One and number Two turned to each other and let loose with a rapid exchange of noise my computer could not translate. Then after a couple of minutes, they turned back to me.

"Follow me." Then they went back to the spin coupler without another word.

I shook my head with a sigh and went after them. This was getting to be a frustrating habit. But I had to smile as I imagined them being interviewed for a television talk show.

The trip back was uneventful, except that when we paraded back through the jungle to the wall I thought I sensed a different "feel" to the massed Travelers. I hated to an-

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thropomorphize, but I seemed to sense consternation and confusion from the way they were milling about as they cleared a path for us. I stopped as we reached the wall where a small display panel about one meter high by two meters wide had been set up.

"What do you wish to see?" my escort asked in unison, breaking their silence.

I pointed up at the mural. "Can you show me a close-up of these panels on this display? The last eight . . . close-ups of the bottom borders?"

Number One let out a long squeal that was continued and complemented by number Two. After a moment, the display lit up with the exact view I had been looking for.

I got down on my knees and peered closely at the declining numbers of Travelers depicted at the base of the bottom panels, and then I moved up towards the final one. At first, I didn't see anything new; just a tragically shrinking population. But it didn't take long to see what I had missed the first time.

Not only were the number of the Travelers shown shrinking, but in each panel there were an increasing number of figures that were different than the rest, even if just slightly. Some were missing eyes or legs, and others were smaller than normal or just slightly misshapen—but there were more and more of these mutant Travelers among the population census figures. The angry sun was doing more than damaging the planet—it was mutating the Travelers!

I had suspected that radiation had been a problem, but this was worse than I had feared.

I thought about this one isolated group of a dying species traveling for hundreds—maybe thousands—of years wanting nothing more than to find another home, and maybe another intelligent life form. Their own SETI projects had been an integral part of their lives and now with me, they finally had a chance to show someone else that they existed and what they had accomplished. But we were a biologically incompatible species, and Earth had no room for weary travelers.

Their lack of curiosity about us had continually bothered me, and now I was more convinced than ever that I knew why. I just had two more questions to be sure.

"Was I supposed to monitor your ship as it left the station to continue your journey?"

"Yes." The monosyllabic chorus was immediate.

"Show me your projected course on leaving orbit."

There had been a constant background of soft whistling and rumbling from the moment we had returned, but suddenly every sound was gone. I had always wondered about the expression "deafening silence," but no longer. There was a numbing quality about the abrupt cessation of all noise. And except for my escort, every Traveler in sight was suddenly staring at me. Number One and number Two had turned to each other, their arms linking up in an embrace of fine cilia that was so tight that I couldn't tell where one ended and the

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other began.

I didn't know how, but I was sure now that I had been right. I held my breath.

Then a joint burst of noise prompted a change in the screen and I found myself looking at a stylized diagram of the Solar System with the space station and the Traveler ship realistically shown, though obviously out of scale. I moved closer and saw the pyramidal pods slowly stop rotating and fold down as the ship accelerated in-system. Even though the tiny graphic moved rapidly, I found myself gritting my teeth and mumbling softly under my breath: "Slingshot! Slingshot!" It would make sense to take advantage of the Sun's gravity well and I kept hoping that that was what they had planned. But it didn't take long before that last hope was removed.

They were heading right for the Sun!

I had been right. It made a certain morbid sense. One of the two major goals of their existence had just been fulfilled, but the other must now have seemed even more impossible than ever. How much motivation did they really have for continuing? It also explained their abruptness and unwillingness to learn anything about us. If they got "to know" us, they might want to continue communication, and that was a long-term endeavor. Given their racial curiosity about space, their lack of interest in us had not made sense—until now. I suspected that they were more like us than they wanted to admit.

My mind filled with memories of Ellen and thoughts of death and coping as I remembered how I had felt after her death. I had suddenly been alone for the first time in years and I had been totally unable to imagine what I would do without her. The one thing that had helped me though my literally clinical depression had been Ellen's mother.

Cecilia Carstairs-Holland. She had been a constant and delightful assurance of how Ellen would never lose her beauty. And her patient handling of my self-pity and depression had saved me. I remembered something she had told me one morning when she had come over for breakfast—after I had finally started to regain my perspective.

We had been sitting at the kitchen table sipping honey-sweetened Almond Sunset tea when somehow the conversation turned to a failed crisis-intervention effort of hers. Angry at herself for failing to prevent a suicidal caller from taking his own life, she had told me that there were four types of suicide-related patients that she regularly dealt with.

The first type she never heard from because they were the ones with conviction who simply found a quiet, effective way to kill themselves, and did it. The second type were the ones who called and threatened but had no intention of killing themselves. They just wanted attention. Then there were the borderline types who might very well do it, but they usually called someone and hoped to be talked out of it. I remembered that Cessi had been tactful with the description since I had been in that category. And

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finally, there were the ones who were also determined to kill themselves, but couldn't quite bring themselves to do it. Instead, they often called a crisis line or a friend, and did it right "in front" of them in order to have a witness to blame.

Cessi, unfortunately, had had that type of caller, and he had pulled the trigger while on the phone with her.

It was the most difficult type to deal with. There was no way of stopping them because they had someone to subconsciously transfer blame to. "See, it's not my fault. If you had been doing your job, or *really* been a friend, you would have stopped me."

I hoped the Travelers weren't in that category.

Drawing a deep breath with a smile—I wasn't going to be doing any talking, but the feeling was the same—I tried to think of the best way of dealing with this. I knew enough to be sure that the last thing I needed to do was to try to literally "talk them out of it." That was a sure way of making the situation worse. It would also guarantee that they would ignore me. Instead, I had to play on their curiosity.

They had spent ages looking for other life; wondering about it, and preparing for a meeting. It was the main reason that I had been able to start "talking" to them so quickly. They had to be curious about us, but they had been careful not to learn too much.

Well, it was time to sabotage that a little.

But I didn't want to start talking about Earth history and knowledge, because that was "data" and would just be ignored. So I decided to start on a more personal level and I reached down to type:

"I need to tell you about myself. It is time for you to be Witness to my Journey. I insist on this to keep balance, and I wish to speak to all of you. If you do not agree, I will erase the recordings I have made." I cringed inside. This had better work, or I would be in *really* deep trouble when I got back.

But I crossed my arms defiantly and waited while my escorts seemed to argue something. Maybe not as much of one mind as I had thought?

Finally they turned back to me. "Speak," they intoned together.

The first hurdle had been passed. I drew another breath and reached down. I remembered the wording of my first escort and started with: "I will tell you about my own birth, life, and death." One step at a time.

"The birth of my race began much the same as yours, with simplicity slowly organizing and growing in complexity. Our Sun has not been a threat as yours, but our menace grows from within. We are a race of one rather than paired as you are, and as a race of one we face problems your people do not: problems of cooperating and working and living as a whole.

"And as separate entities, these problems affect us on an individual basis. Much as you live as units of two, many of us strive to do the same, for reproductive as well as emotional reasons. To form a harmonious unit is the ultimate goal for many, and I

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formed such a unit with an individual called Ellen. Our lives were joined for many years—until the time of my 'death'. . . ."

My throat constricted as I forced myself to *really* remember. After my earlier fears of loving anyone, finding Ellen had been an unexpected blessing I had almost been unable to trust. And when she had died, it had nearly been too much to handle. But now I had to face the pain all over again because the parallel between my experience and the Traveler history was obvious. I had to show it was possible to go on living. I could only hope enough of my words survived the translation as I told them briefly about childhood losses, growing up, and finally finding Ellen—and then losing her.

My eyes blurred and instead of my attentive alien audience I saw sheeting rain on the windshield of Ellen's car as we drove home after a late dinner at Fleur de Lis. It had been our twelfth wedding anniversary, May 20th, 2017 . . . the last one we had shared. . . .

I had gone all out to reserve one of the dining rooms just for the two of us, and I had hired a classical trio from a nearby college to play. I wanted this to be an extra special anniversary because Ellen had just sold her first novel. While I had astronomy for a hobby as well as a profession, her hobby had been writing mysteries. She had been writing and selling short stories for years and had finally—after much urging on my part—decided to try a full-length novel. And she had sold it to a mid-sized publisher, with a fair advance for CD-Text, Electronic and Print rights.

That deserved a celebration.

The candle-lit dinner was perfect, with a falling-apart tender trout *aux amandes,* broccoli with Hollandaise sauce, new potatoes simmered with an incredible fresh herb seasoning, fresh warm rolls on the side, a spectacular Chenin Blanc—only a single glass apiece because we wanted fully clear heads for the rest of the night—and a sinfully rich chocolate cake for dessert. Gentle music from Mozart, Dvořák and Bach eased our digestion, and we left the restaurant walking on air. A sudden rain shower did nothing to dampen our spirits.

Since my car was in the shop, we were using Ellen's and naturally she was driving. Her convertible was her baby. The rain was light but we took it easy as we headed home, anxious to get more intimate. I was trying not to look too anxious as I pictured her finding her present on her pillow: I had found a first edition of an early Agatha Christie novel that I knew she had been dying to add to her collection. It had cost me an arm and a leg, but after our last anniversary, when she had bought me an antique telescope I had been eyeing, I had been determined to find her something equally appropriate.

With the fogging up of the inside rear window, neither of us had seen the dark blue van that had been behind us until it was right on our rear bumper. It was running without headlights in the early evening gloom, the driver obviously impatient over El-

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len's careful driving at the speed limit. He didn't seem to care that the small manual-control road we were on was a two-lane one with no-passing markings laid down, because as soon as a gap opened in the oncoming traffic, he floored it to pass us, ignoring the blaring alarm that was certainly coming from his dashboard as he crossed over the electronic road-markers; an alarm already logged in his violations box, unless it had been disconnected.

Ellen had seen it, and she calmly moved over as much as possible and slowed down to give him room, but we were approaching a curve and unseen to the van, a large truck was just coming around it, lights flashing angrily on high as the truck driver slammed on the brakes. The van driver panicked and swerved right into us, the shock throwing me against the side window hard enough to stun me.

The next few moments passed in a blurred haze as our car ran up on a stone wall to our right and flipped, spinning and sliding to slam into the oncoming truck with a numbing crash that caused me to black out.

I awakened in the hospital almost ten hours later. I had had three broken ribs, a broken leg and a concussion, but all that had been forgotten in the agony of learning that Ellen was dead. The truck had hit her side of the car, and while the rollbar had saved us when the car had flipped, the windshield frame had been ripped loose to plunge into Ellen's chest, driven by the impact to kill her instantly.

And again I had been alone.

Just as the Travelers were alone, cut off from the other isolated groups of their race wending their lonely ways across the Universe—and forever lost to the millions who had been killed by their dying sun.

My fingers were stiff and cramping on me as I stopped typing momentarily and shivered. The force of the repressed memories I had unleashed was frightening . . . and yet, no longer intolerable. A new emotion was taking hold. Anger—though not a consuming or destructive one. Instead, I felt a surge of irritation as I realized how much emotion had been wasted in self-pity instead of healthy mourning, in bitter depression instead of appreciation for the time I had shared with Ellen. Somewhere in the depths of my despair I had lost sight of "her."

I cringed as I went on to describe how, after an uncharacteristic fit of drinking, I had managed to find a gun and almost turned it on myself. Only a timely call from Cecilia had saved me. Somehow she had known I was at a crisis point even though I had blocked her—and everyone connected with Ellen—out of my life. We had talked for hours while I had sat there with my finger on the trigger, until she had finally talked me down to collapse into tears with the gun tumbling unused to the floor.

I still had that gun. It was mounted on a wooden plaque—its firing pin removed—and hung in my study as a reminder of the ultimate mistake that I had *almost* made.

I flexed my stiff fingers and then let them continue. I started to describe how I had finally found myself again

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in my work, but as I did, I realized that I was lying. I still had not let go of Ellen. I had just substituted one obsession with another. It was a sobering thought, and it brought home the reason I had started all this soul-searching in the first place.

I drew myself up and moved closer to my escorts to look them right in the eyes.

"You have suffered losses I cannot even imagine, and you have had a difficult journey. But one thing you had almost given up hope of finding was other life to be witness. But you found us. If there are two intelligent life forms in the Universe, could there not be three? And if there was one compatible planet for you, might there not be another? If you keep searching?"

I tried not to laugh as I remembered one of those sayings attributed to the mythical "they": "Physician, heal thyself." Ellen was gone, but considering the last few days, it was definitely time for me to stop hiding from the world. What were my losses compared to the suffering of the Travelers? We both needed to move on and continue searching.

"There is much we can teach you," I added, "and much we can learn from you. Wouldn't it make more sense to continue your journey, and to keep communicating and sharing information?"

There was nothing more to add, and I put away the Braille Pad and dropped to the ground and leaned back against the history mural to wait for their decision. It was their turn.

* * *

Over an hour later English words snapped me awake. The orchestral barrage of rumbles and squeals my speech had prompted had actually lulled me to sleep as I sat there. I felt my face burning as I asked for a repeat and immediately heard a joint declaration:

"You are giving me much to consider and I need more time. I will take you back to your vessel. Return to your space station, and I will call you." Then I was politely escorted back to the shuttle without another word.

III.

My return had not been as friendly—or as silent.

Babek had tried to run interference for me, but the rest of the U.N. contact team had ganged up on me with a barrage of questions as I was escorted into quarantine. And once my recordings had been reviewed, the questions had turned positively hostile. Only Babek had defended my decisions—but without luck. It had not helped that, on the third day, the Traveler ship had left orbit without warning and headed in-system.

Fortunately I had been released into Irene's care by that time. She had transferred me to replace my own eyes and I had happily taken refuge in the hospital—protected by vigilant nurses who kept out all non-medical personnel. But I had been terrified by the Travelers's departure and refusal to answer my calls. I had spent that third day in the darkness, blindfolded after the operation but vividly seeing the stylized Traveler ship on the small screen heading for its inevitable blaz-

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ing self-destruction.

Babek and Irene had kept assuring me that they thought I had done the right thing—I had told Irene everything even if she was not cleared—but it had not helped.

And now it was time to face the music.

The door slid open and Babek's ursine bulk crowded the doorway as he held out a squeeze bottle of beer.

"This is against regs, buddy, but hey, you must have been born under a lucky star. How's the eyes?"

I shrugged. "Good enough to fill out a stack of job applications." But from the way he was smiling, I wasn't worried.

"I'm afraid you'll have to postpone that. Think autograph signing instead. And think television interviews and CD publication contracts—"

"I take it the Travelers have broken their silence?" My heart was racing as I saw the glint in his eyes.

"You got it. They just called and—get this—apologized for the sudden departure! It seems that they have picked out a new heading and needed to leave orbit while they were in a good position. They're doing a slingshot, and then heading out."

"They can't stay any longer?"

"Apparently not, but they're already sending us stuff—including complete schematics of their spaceship! And they want us to send them as much information about us as we want to share!" He grabbed my arm. "Come on. We're meeting my wife in the Floater Lounge for celebration drinks. On me. And I even dug up a date for you. I just met this redheaded Irish doctor who thinks you're hot stuff, and I talked her into coming along." He shook his head. "For some misguided reason, she even thinks you're cute." ■

To treat your facts with imagination is one thing, but to imagine your facts is another.

—John Burroughs

It is a miserable state of mind to have few things to desire, and many things to fear.

—Francis Bacon

Statistics are like a bikini. What they reveal is suggestive, but what they conceal is vital.

—Aaron Levenstein

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Robert M. Zubrin

THE MARTIAN FRONTIER

Illustration by Vincent Di Fate

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People who make history sometimes become historians, but it's not often that academic historians make history. It has happened though, once, just over a hundred years ago, when a young professor from the then relatively obscure University of Wisconsin got up to speak to a late night session at the annual conference of the American Historical Association.

"To the frontier the American intellect owes its striking characteristics. That coarseness of strength combined with acuteness and inquisitiveness; that practical, inventive turn of mind, quick to find expedients; that masterful grasp of material things, lacking in the artistic but powerful to effect great ends; that restless, nervous energy; that dominant individualism, working for good and evil, and withal that buoyancy and exuberance that comes from freedom—these are the traits of the frontier. . . . Since the days when the fleets of Columbus sailed into the waters of the New World, America has been another name for opportunity, and the people of the United States have taken their tone from the incessant expansion which has not only been open but has even been forced upon them. He would be a rash prophet who should assert that the expansive character of American life has now entirely ceased. Movement has been its dominant fact, and, unless this training has no effect upon a people, the American energy will continually demand a wider field for its exercise. But never again will such gifts of free lands offer themselves. For a moment, at the frontier, the bonds of custom are broken and unrestraint is triumphant. . . . Each frontier did indeed furnish a new opportunity, a gate of escape from the bondage of the past; and freshness, and confidence, and scorn of older society, impatience of its restraints and its ideas, and indifference to its lessons, have accompanied the frontier. What the Mediterranean Sea was to the Greeks, breaking the bonds of custom, offering new experiences, calling out new institutions and activities, that, and more, the ever retreating frontier has been to the United States directly, and to the nations of Europe more remotely. And now, four centuries from the discovery of America, at the end of a hundred years of life under the Constitution, the frontier has gone, and with its going has closed the first period of American history."

Thus spoke Frederick Jackson Turner in his famous talk which in a single evening catapulted him from obscurity to the top of the historian's profession. In one bold sweep of brilliant insight, Turner laid bare the source of the American soul. It was not legal theories, precedents, traditions, national or racial stock that was the source of the egalitarian democracy, individualism, and spirit of innovation that characterized America, it was the existence of the Frontier. The frontier creates a perpetual labor shortage in the settled areas, which drives up wages and thus technological innovation. With people in short supply, each one is valued more preciously, putting a premium on popular education and elevating the

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general estimate of the human dignity of the common man. So long as the frontier exists, the factory worker back East always has another option in the West, and even if he does not choose to exercise it, he has to be treated with the respect due to someone who can quit—who works by choice, not duress. So long as the frontier is open and new fortunes can be made the establishment of a closed aristocracy is impossible.

Within a few years the Turner thesis created an entire school of historians who proceeded to demonstrate that not only American culture, but worldwide western progressive humanist civilization generally, was the result of the Great Frontier of global settlement opened to Europe by the Age of Exploration. It was the Great Frontier that shattered the static and stratified world of medieval Christendom, unchaining thought, hope, and imagination to revolutionize the world.

But what of now? With the end of the frontier, what happens to America and all it has stood for? Can a free, egalitarian, democratic, innovating society be preserved in the absence of room to grow? What do we see around us now but an ever more apparent loss of vigor of American society, bureaucratization of all levels of society, impotence of political institutions to carry off great projects, the proliferation of regulations affecting all aspects of public and private life, the spread of irrationalism, the banalization of popular culture, the loss of willingness by individuals to take risks, to fend or think for themselves, economic stagnation, the deceleration of the rate of technological innovation, and a loss of belief in the idea of progress itself? Everywhere we look, the writing is on the wall. Without a frontier from which to breathe life, the spirit that gave rise to the progressive humanistic culture that America for the past several centuries has offered to the world, is fading. Without a frontier to grow in, not only American society, but the entire global civilization based upon Western values of humanism, reason, science, and progress will ultimately die.

The creation of a new frontier thus presents itself as America's and humanity's greatest social need. I believe that this new frontier can only be on Mars.

It is true that settlements on or under the sea or in Antarctica are entirely possible, and their establishment would be much easier than that of Martian colonies. Nevertheless, at this point in history such places are insufficiently remote to allow for the free development of a new society. In this day and age, with modern terrestrial communication and transportation systems, anywhere on Earth the cops are too close. If people are to have the dignity that comes with making their own world, they must be free of the old.

The Moon won't do, because there's not enough there. True, the Moon has a copious supply of most metals and oxygen, in the form of oxidized rock, and a fair supply of solar energy, but that's about it. For all intents and purposes, the Moon has no hydrogen, nitrogen, or carbon, and

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these are three of the four elements most necessary for life. You could bring seeds to the Moon and grow plants in enclosed greenhouses there, but nearly every atom of carbon, nitrogen, and hydrogen that goes into making those plants would have to be imported from another planet. While sustaining a lunar scientific base under such conditions is relatively straightforward, growing a civilization there would be impossible. The difficulties supporting significant populations in artificial orbiting space colonies would be even greater.

Mars has what it takes. It's far enough away to free its colonists from intellectual, legal, or cultural domination by the old world, and rich enough in resources to give birth to a new. The Red Planet may appear at first glance to be a desert, but beneath its sands are oceans of water in the form of permafrost, enough in fact, if it were melted and Mars's terrain were smoothed out, to cover the entire planet with an ocean several hundred meters deep. Mars's atmosphere is mostly carbon dioxide, providing enormous supplies of the two most important biological elements in a chemical form from which they can be directly taken up and incorporated into plant life. Mars has nitrogen too, both as a minority constituent (3%) in its atmosphere and probably as nitrate beds in its soil as well. For the rest, all the metals, silicon, sulfur, phosphorus, inert gases, and other raw materials needed to create not only life but an advanced technological civilization, can readily be found on Mars.

How the Martian Frontier Can be Opened

It is essential that a frontier be distant, but not unreachable. Mars is now within reach. The technology exists now, and for sometime past, such that, within ten years of the starting of a program, human explorers could set foot on Mars. The cost to develop all the hardware needed for a human exploration program of Mars would be several tens of billions, considerably less than the Apollo program ($70 billion in today's money), and much less than the $400 billion estimate associated with the NASA "90 Day Report" of 1989, which projected a 30 year time line before a piloted Mars mission could be attempted. Nevertheless, the lower cost and schedule estimates are entirely feasible.

Of course, it is always possible to plan an exploration mission on such a grandiose scale that it is unaffordable, and it is always possible to settle on a mission technique that drives matters in such a direction. For example, in the 19th century, the British Navy sent dozens of expeditions, at great expense, to explore the Canadian arctic for the Northwest Passage. Consisting of flotillas of steam-powered warships loaded with coal and supplies, these expeditions would battle forward against the ice packs for several years at a time, until shortages would force an about-face with little to show for the effort. At the same time, however, small teams of explorers working for fur trapping interests were traveling freely over the arctic

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by dogsled. Living off the land, feeding themselves and their dog teams on native game, they traveled light, and at insignificant expense they accomplished far more in the way of exploration than the naval fleets.

There have been any number of concepts advanced for manned Mars missions that are analogous to the ponderous Royal Navy approach to arctic exploration cited above. Grand ships are required, hauling out to Mars all the supplies and propellant that will be needed for the entire mission. Because such ships are too large to be launched in one piece, construction in orbit is required, as is long-term orbital storage of cryogenic propellant; large orbiting facilities are required to enable both of these operations, and the cost of the whole project goes out of sight.

However, as in the case of arctic exploration, there is a different way a Mars mission can be approached, a "dogsled" way if you will, that by making intelligent use of the resources available in the environment to be explored, allows the logistical requirements for launching the mission to be reduced to the point where the endeavor becomes practical.

Recently, a concept known as the "Mars Direct" plan[1] was proposed which approaches the problem of a Mars mission in this spirit. In this plan, no large interplanetary spaceships are used, and thus no orbiting space bases are needed to construct and service them. Instead, the astronauts in their habitat are sent direct to Mars by the upper stage of the same booster rocket that lifted them to Earth orbit, in just the same way as the Apollo missions and all unmanned interplanetary probes launched to date were flown. While granting the attractiveness of the simplicity of such a scheme, conventional wisdom would deem it infeasible, as the mass of propellant and supplies needed for a manned Mars mission is much too large to be launched in such a way. Conventional wisdom would be right except for one thing: if done in a clever way, most of the propellant and supplies needed for the mission do not have to be launched from Earth at all. They can be found on Mars.

Here's how the Mars Direct plan works. At an early launch opportunity, for example 2001, a single heavy lift booster with a capability equal to that of the Saturn V used during the Apollo program is launched off Cape Canaveral and uses its upper stage to throw a 40 tonne unmanned payload onto a trajectory to Mars. Arriving at Mars eight months later, it uses friction between its aeroshield and Mars's atmosphere to brake itself into orbit around Mars, and then lands with the help of a parachute. This payload is the Earth Return Vehicle (ERV), and it flies out to Mars with its two methane/oxygen driven rocket propulsion stages unfueled. It also has with it 6 tonnes of liquid hydrogen cargo, a 50 kilowatt nuclear reactor mounted in the back of a methane/oxygen driven light truck, a small set of compressors and automated chemical processing unit, and a few small scientific rovers.

As soon as landing is accomplished, the truck is telerobotically driven a

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few hundred meters away from the site, and the reactor is deployed to provide power to the compressors and chemical processing unit. The hydrogen brought from Earth can be quickly reacted with the Martian atmosphere, which is 95% carbon dioxide gas (CO_2), to produce methane and water, and this eliminates the need for long term storage of cryogenic hydrogen on the planet's surface. The methane so produced is liquefied and stored, while the water is electrolyzed to produce oxygen, which is stored, and hydrogen, which is recycled through the methanator. Ultimately these two reactions (methanation and water electrolysis) produce 24 tonnes of methane and 48 tonnes of oxygen. Since this is not enough oxygen to burn the methane at its optimal mixture ratio, an additional 36 tonnes of oxygen is produced via direct dissociation of Martian CO_2. The entire process takes 10 months, at the conclusion of which a total of 108 tonnes of methane/oxygen bipropellant will have been generated. This represents a leverage of 18:1 of Martian propellant produced compared to the hydrogen brought from Earth needed to create it. 96 tonnes of the bipropellant will be used to fuel the ERV, while 12 tonnes are available to support the use of high-powered chemically fueled long range ground vehicles. Large additional stockpiles of oxygen can also be produced, both for breathing and for turning into water by combination with hydrogen brought from Earth. Since water is 89% oxygen (by weight), and since the larger part of most foodstuffs is water, this greatly reduces the amount of life support consumables that need to be hauled from Earth.

The propellant production having been successfully completed, in 2003 two more boosters lift off the Cape and throw their 40-tonne payloads towards Mars. One of the payloads is an unmanned fuel-factory/ERV just like the one launched in 2001, the other is a habitation module containing a crew of four, a mixture of whole food and dehydrated provisions sufficient for three years, and a pressurized methane/oxygen driven ground rover. On the way out to Mars, artificial gravity can be provided for the crew by extending a tether between the habitat and the burnt out booster upper stage, and spinning the assembly. Upon arrival, the manned craft drops the tether, aerobrakes, and then lands at the 2001 landing site where a fully fueled ERV and fully characterized and beaconed landing site await it. With the help of such navigational aids, the crew should be able to land right on the spot; but if the landing is off course by tens or even hundreds of miles, the crew can still achieve the surface rendezvous by driving over in their rover; if they are off by thousands of miles, the second ERV provides a backup. However, assuming the landing and rendezvous at site number 1 is achieved as planned, the second ERV will land several hundred miles away to start making propellant for the 2005 mission, which in turn will fly out with an additional ERV to open up Mars landing site number 3. Thus every other year two heavy lift

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boosters are launched, one to land a crew, and the other to prepare a site for the next mission, *for an average launch rate of just one booster per year to pursue a continuing program of Mars exploration*. This is only about 10% of the US launch capability, and is clearly affordable. In effect, this dogsled approach removes the manned Mars mission from the realm of mega-fantasy and reduces it to practice as a task of comparable difficulty to that faced in launching the Apollo missions to the Moon.

The crew will stay on the surface for 1.5 years, taking advantage of the mobility afforded by the high-powered chemically driven ground vehicles to accomplish a great deal of surface exploration. With a 12-tonne surface fuel stockpile, they have the capability for over 14,000 miles worth of traverse before they leave. Since no one has been left in orbit, the entire crew will have available to them the natural gravity and protection against cosmic rays and solar radiation afforded by the Martian environment, and thus there will not be the strong driver for a quick return to Earth that plagues conventional Mars mission plans based upon orbiting mother-ships with small landing parties. At the conclusion of their stay, the crew returns to Earth in a direct flight from the Martian surface in the ERV. As the series of missions progresses, a string of small bases is left behind on the Martian surface, opening up broad stretches of territory to human cognizance.

And that's it. No miraculous new technologies, no orbiting spaceports, and no gigantic interplanetary space cruisers are needed to get humans to Mars. Our first base on Mars could be established in ten years. All that's needed is present-day technology, some nineteenth century industrial chemistry, and a little bit of moxie. The required program budget, about $2 billion a year, would be less than 15% of NASA's budget, less than 0.7% of the US military budget, less than 0.2% of the US government budget, and essentially not even measurable as a fraction of either the legal or illegal gross national product. The arguments that Mars is either unattainable or unaffordable in our time are simply untrue.

Once humans have reached Mars, bases could rapidly be established to support not only exploration, but experimentation to develop the broad range of civil, agricultural, chemical and industrial engineering techniques required to turn the raw materials of Mars into food, propellant, ceramics, plastics, metals, wires, structures, habitats, etc. As these techniques are mastered, Mars will become capable of supporting an ever increasing population, with an expanding division of labor, capable of mounting engineering efforts on an exponentially increasing scale. Once the production infrastructure is in place, populating Mars will not be a problem—under current medical conditions an immigration rate of 100 people per year would produce population growth on Mars in the 21st Century comparable to that which occurred in colonial America in the 17th Century. Within a century, an engineering capability

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could be created on Mars with the capability to literally transform the planet, if not to a fully Earth-like environment, at least to the warm, wet conditions of Mars's primitive past, making a desert world into a new home for a new spectrum of descendants of terrestrial life.

The above scenario may be technically feasible, some say, but how can it be financed? While the initial exploration and base building activities on Mars can be supported by government largess, a true colony must eventually become economically self-supporting. Unlike the Moon, the vast majority of Martian necessities, food, clothing, brick, concrete, plastics, etc., can be produced locally, but there will always be some high technology items that will have to be imported from Earth. How can these be paid for? What does Mars have to export? The answer is: *Mars may have nothing to export today, but once people are there, it will have plenty to export. Mars will be able to export ideas.* The Mars colony will be a society with a severe labor shortage battling a harsh environment with technology and innovation. Just as the labor shortage prevalent in colonial and 19th century America drove the creation of Yankee Ingenuity's flood of inventions, so the conditions of extreme labor shortage combined with a technological culture and the unacceptability of impractical legislative constraints against innovation will drive Martian ingenuity to produce wave after wave of invention in energy production, automation and robotics, biotechnology, and other areas. These inventions, licensed on Earth, will finance Mars even as they revolutionize and advance terrestrial living standards as forcefully as 19th century American invention changed Europe and ultimately the rest of the world as well. Mars will be able to pay its way.

Mars can be settled, and the fact that Mars can be thus settled and altered defines it as the New World that can create the basis for a positive future for *terrestrial* humanity for the next several centuries.

Why Humanity Needs Mars

The essence of humanist society is that in it human beings are valued, that human life and human rights are held precious beyond price. Such notions have been for several thousand years the core philosophical values of Western civilization, dating back to the Greeks and the Judeo-Christian ideas of the divine nature of the human spirit. Yet they could never be implemented as a practical basis for the organization of society until the great explorers of the age of discovery threw open a New World in which the dormant seed of medieval Christendom could grow and blossom forth into something the likes of which the world had never seen before.

The problem with Christendom was that it was *fixed;* it was a play for which the script had been written and the leading roles both chosen and assigned. The problem was not that there were insufficient natural resources to go around—medieval Europe was not heavily populated, there

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were plenty of forests and other wild areas—the problem was that all the resources were *owned*. A ruling class had been selected and a set of ruling institutions, ideas and customs had been selected, and by the law of "Survival of the Firstest," none of these could be displaced. Furthermore, not only the leading roles had been chosen, but also those of the supporting cast and chorus, and there were only so many such parts to go around. If you wanted to keep your part, you had to keep your place, and there was no place for someone without a part.

The New World changed all that by supplying a place in which there were no established ruling institutions, an improvisational theater big enough to welcome all comers with no parts assigned. By doing so, it reversed the sign on society's estimate of the value of man. In the New World it was made plain to see that human beings can be the creators of their world, and not just its inhabitants. By raising the price of labor and defining a situation in which innovation to maximize the abilities of the limited population available was desperately needed, it drove progress; initially allowing escape from, but ultimately forcing the destruction of those institutions globally whose continued rule required continued stagnation. If not for the opening of the New World, we today would not be free.

Now consider the probable fate of humanity in the 21st Century under two conditions, with a Martian Frontier, and without it.

Without the opening of a new frontier on Mars, continued Western civilization faces the risk of technological stagnation. To some this may appear to be an outrageous statement, as the present age is frequently cited as one of technological wonders. In fact, however, the rate of progress within our society has been decreasing, and at an alarming rate. To see this, it is only necessary to step back and compare the changes which have occurred in the past 30 years with those that occurred in the 30 years preceding and the 30 years before that. Between 1905 and 1935 the world was revolutionized; cities were electrified, telephones and broadcast radio became common, talking motion pictures appeared, automobiles became practical, and aviation progressed from the Wright Flyer to the DC-3 and Hawker Hurricane. Between 1935 and 1965 the world changed again, with the introduction of color television, communication satellites and interplanetary spacecraft, computers, antibiotics, SCUBA gear, nuclear power, Saturn rockets, jet airliners, and SR-71's. Compared to these changes, the technological innovations from 1965 to the present are insignificant. Immense changes should have occurred during this period, but did not. Had we been following the previous 60 years' technological trajectory, we today would have videotelephones, solar-powered cars, maglev trains, fusion reactors, hypersonic intercontinental travel and regular passenger transportation to orbit, undersea cities, open-sea mariculture, and human settlements on the Moon and Mars. But we don't. Instead we have a growing antitechnology move-

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ment agitating against nuclear power and biotechnology. In the post-Frontier world the question is no longer "Will it work?" but "Is it safe?" or "Are you sure it won't bother us?" Increasingly preservation is paramount, innovation heresy. Stagnation looms.

But consider a nascent Martian civilization: its future will depend critically upon the progress of science and technology to which the colonists will therefore enthusiastically contribute. Following the model of "Yankee Ingenuity's" role in revolutionizing human society in the 19th century, "Martian Ingenuity" born in a culture that puts the utmost premium on intelligence, practical education, and the determination required to make real contributions will make much more than its fair share of the scientific and technological breakthroughs that will dramatically advance the human condition in the 21st.

A prime example of where this is likely to occur is energy production. Mars does have one major energy resource that we know about: deuterium, which can be used as the fuel in thermonuclear fusion reactors. Earth has large amounts of deuterium too, but with all of our existing investments in other, more polluting, forms of energy production, we have allowed fusion research to stagnate. The Martian colonists are certain to be much more determined to get fusion on-line, and in doing so will massively benefit the mother planet as well. Fusion power will also lead to fusion propulsion, making possible spaceships that will carry hundreds of passengers and thousands of tons of payload rapidly back and forth between Earth and Mars, thus accelerating the rate of colonization and opening up the possibility of emigration to Mars to more and more people. Not only would such technology cause travel times between Earth and Mars to shrink from months to weeks, but travel times to the outer Solar System would be reduced from years to months, and even voyages to the stars could become possible on a time scale of decades instead of millennia. Thus by acting as a driver on technology, the Martian Frontier can become a gateway to the practically infinite hinterland that lies beyond.

The parallel between the Martian frontier and that of 19th century America as technology drivers is, if anything, vastly understated. America drove technological progress in the last century because its western frontier created a perpetual labor shortage in the east, thus forcing the development of labor saving machinery and providing a strong incentive for improvement of public education so that the skills of the limited labor force available could be maximized. This condition no longer holds true in America, in fact, far from prizing each additional citizen, immigrants are no longer welcome here and a vast "service sector" of bureaucrats and menials has been created to absorb the energies of the majority of the population which is excluded from the productive parts of the economy. Thus in the late 20th century, the increasingly in the 21st, each additional citizen is and will be regarded

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as a burden. On 21st century Mars, on the other hand, conditions of labor shortage will apply with a vengeance. Indeed, it can be safely said that no commodity on 21st century Mars will be more precious, more highly valued, and more dearly paid for than human labor time. Pay rates will be higher on Mars, workers will be treated better, and public education will be driven much harder than ever was the case on Earth. Just as the example of 19th century America changed the way the common man was regarded and treated in Europe, so the impact of progressive Martian social conditions will not only be felt on Mars. Put simply, a new standard will be set for a higher form of humanist civilization on Mars, and viewing it from afar the citizens of Earth will rightly demand nothing less for themselves.

The frontier drove the development of democracy in America by creating a self-reliant population which insisted on the right to self-government. It is doubtful that democracy can persist without such people. True, the trappings of democracy exist in abundance in America today, but meaningful public participation in the process has all but disappeared. No representative of a new political party has been elected president of the US since 1860, neighborhood political clubs and ward structures that allowed citizen participation in party deliberations are gone, as are the camp meetings and torchlight election parades. Regardless of the will of Congress, the real laws, covering ever broader areas of economic and social life, are increasingly being made by a plethora of regulatory agencies whose officials do not even pretend to have been elected by anyone. Despite *pro forma* elections of judges, the judicial system has come to function largely as an autonomous legal caste deciding the fate of its subjects not on the basis of justice, but on the basis of its own capricious technicalities. Clearly, if it is not to continue its ongoing degeneration into sham, democracy in America and elsewhere in western civilization needs a shot in the arm. That boost can only come from the example of a frontier people whose civilization incorporates the ethos that breathed the spirit into democracy in America in the first place. As Americans showed Europe in the last century, so in the next the Martians can show us the way away from oligarchy.

If the frontier remains closed in the 21st Century we face the spread of various sorts of anti-human ideologies and the development of political institutions that incorporate their notions. At the top of the list of such pathological closed-world ideas is the Malthus theory, which holds that since the world's resources are more or less fixed, population growth must be restricted or all of us will descend into bottomless misery. All predictions made upon the Malthus theory to date have been wrong, because human beings are not mere consumers of resources. Rather we create resources by the development of new technologies that find use for them. The more people, the faster the rate of innovation, and this is why contrary to

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Malthus, as the world's population has increased, the standard of living has increased, and at an accelerating rate. Whether or not this process can continue indefinitely on one planet is debatable, but moot, as *with continued exponential technological progress* we can have the ability to emigrate large populations to space long before Earth actually becomes seriously overcrowded. (When you think of humanity's future space lift capabilities, don't think of our existing primitive launch systems, think of airplanes. Currently, the number of people taking off from US airports in jet aircraft every year exceeds the US population by an order of magnitude. Ninety-three years ago airplanes were considered fantasy. Today, the entire population of the United States could be evacuated *by air* in less than two months). Nevertheless, in a closed one-world society Malthusianism has the appearance of self-evident truth, and herein lies the danger. Because if the idea is accepted that the world's resources are fixed, then each person is ultimately the enemy of every other person, and each race or nation is the enemy of every other race or nation. The inevitable result is the creation of tyrannical regimes to restrict population growth, such as that now prevailing in China, or worse, the development of Nazi-style genocidal governments as various populations become convinced that their vital self interest requires the elimination of those other races that are allegedly competing with them for the world's finite resources. Only in a universe of unlimited resources can all men be brothers.

It is not enough to argue against Malthusianism in the abstract; such debates are not settled in academic journals. Unless people can *see* broad vistas of unused resources in front of them, the belief in limited resources tends to follow as a matter of course. Unless the frontier is re-opened, the probability is high that humanity will create hell for itself in the 21st century.

The Never Ending Renaissance

Western humanist civilization as we know and value it today was born in expansion, grew in expansion, and can only exist in a dynamic expanding state. While some form of human society might persist in a non-expanding world, that society will not feature freedom, creativity, individuality, or progress; and placing no value on those aspects of humanity that differentiate us from animals, it will place no value on human rights or human life as well. Such a dismal future might seem an outrageous prediction, except for the fact that for nearly all of its history most of humanity has been forced to endure static modes of social organization, and the experience has not been a happy one. Free societies are the exception in human history; they have only existed during the four centuries of frontier expansion of the West. That history is now over; the frontier that was opened by the voyage of Christopher Columbus is now closed. If the era of western humanist society is not to be seen by future historians as some kind of transitory golden age, a brief shining mo-

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ment in an otherwise endless chronicle of human misery, then a new frontier must be opened. Mars beckons.

But Mars is only one planet, and with humanity's power over nature rising exponentially as they would in an age of progress that an open Martian frontier portends, the job of transforming and settling it is unlikely to occupy our energies for more than three or four centuries. Does the settling of Mars then simply represent an opportunity to prolong but not save a civilization based upon dynamism? Isn't it the case that humanist civilization is ultimately doomed anyway? I think not. The Universe is vast; its resources, if we can access them, are practically infinite. During the four centuries of the open frontier on Earth, science and technology have advanced at an astonishing pace. Four more centuries of freedom would give us powers that would seem magical today. Terraforming Mars will drive the development of new and more powerful sources of energy; settling the Red Planet will drive the development of ever faster modes of space transportation. Both of these capabilities in turn will open up new frontiers ever deeper into the outer Solar System, and the harder challenges posed by these new environments will drive the two key technologies of power and propulsion ever more forcefully. The key thing is not to let the process stop, for if it is allowed to stop for any length of time society will crystallize into a static form that is inimical to the resumption of progress. That is what defines the present age as one of crisis. Our old frontier is closed; the first signs of social crystallization are clearly visible. Yet progress, while slowing, is still extant; our people still believe in it and our ruling institutions are not yet incompatible with it. We still possess the greatest gift of the inheritance of a four hundred year long Renaissance, to wit, the capacity to initiate another by opening the Martian frontier. If we fail to do so, our culture will not have that capacity long. Mars is harsh, the people who settle it will need not only technology, but the scientific outlook, creativity, and free-thinking individualistic inventiveness that stand behind it. Mars will not allow itself to be settled by people from a static society; those people won't have what it takes. We still do. Mars today waits with a new frontier for the children of the pioneers, but Mars will not wait forever.

Like an aircraft moving down a runway, western civilization used the freedom afforded by the open frontier to accelerate itself to takeoff speed. The end of the runway has now been reached. If our journey is to continue, we must now take courage and fly. ■

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Addie Lacoe

MONA

Civilization can build bridges and barriers at the same time. . . .

Illustration by Janet Aulisio Dannheiser

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Mona ignored the presence she felt blocking the doorway to her office cubicle: a man, judging by the mass registering on her telemetry implant, with a step she didn't recognize—a stranger, without an appointment.

A calling card clicked into her "incoming" box. The man should have backed off at that point, leaving her to decide whether she wanted anything to do with him. When he didn't, she reached for the card and stuck it under her scanner. The simulator voice in her ear spoke the words, "Enrique Leon," with his business and home addresses, phones, FAX, e-mail, and references—the standard stuff. A handwritten message, which she deciphered by touch on the projection pad, said only, "May I speak with you?"

She called up his file. Mr. Leon was on the payroll, all right, and this was a sample of his handwriting. But what did he want in Personnel, when he already worked here? His written message sounded like a pick-up line out of a politically-correct primer, making sure nobody could say he'd forced himself on her. His deliberate coldness and the unmistakable smell of fear on him piqued her interest.

She wrote on one of her own cards, "13:22," thirty seconds away, stuck it in an envelope, and dropped it in her "outgoing" box.

Mona heard him pick up the envelope, open it, and then wait, shifting in his soft-soled shoes, his solid bulk still blocking the draft.

In the few seconds she had, she let his bio play out beneath her fingertips: age 27, single, I.Q. 155, degrees from some very impressive schools, nine years in the Engineering Department, now assigned to Special Projects.

She could feel him staring. If she were sighted, he wouldn't have dared caress her with his eyes that way. His concentration was unnerving but also flattering.

In more than five months, since leaving the small college town she'd grown up in, she hadn't had anything even close to what she'd call an actual date. Her supervisor had introduced her around the first day, but then she'd had to sit through a course in business etiquette before the company's next weekend social. Management was supersensitive about avoiding liability for any sexual improprieties. No wonder even the other women in the department were standoffish.

At 13:22, Mona raised her face to her visitor and said, "Yes, Mr. Leon?"

She heard the polite click of his wrist video-recorder and made a show of turning on her own machine, though it was redundant in her case. This was part of the dance everybody did in self-defense against any trumped-up harassment charges.

"Thank you for seeing me, Ms. Klein," he said.

He impressed her, the way he didn't avoid using the word "see." Mona filed a sample voiceprint, but she already knew she wouldn't need it. She loved his resonating baritone. "You don't have to be formal. What can I do for you?"

"There's an interdepartmental get-

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together set for tonight. When you didn't R.S.V.P., I figured you might have missed the announcement."

She had missed it. Few people realized how tedious it could be for her to listen to the entire network bulletin board every day. She liked his thoughtfulness and the way he spoke directly to her, not condescending, not raising his voice or using simple words or exaggerated enunciation. "Which departments?" His and hers, of course, or he wouldn't have risked telling her in the first place.

"Personnel and Special Projects."

"I don't think I know anybody in Special Projects," she said. "I'm sure I haven't screened anybody for there. What're you working on?"

"You'll know some of us," he said. "We were all taken from other departments."

When he stopped short of answering her final question, Mona felt obliged to fill the conversational gap. "Where's it going to be?"

"In Conference Room K, at the Holiday-Sheraton." He slipped a glossy page onto her desk.

It registered as the hotel's floor plan. "I appreciate you letting me know." It was obvious that he'd come prepared. She wondered how far he'd go. If he mentioned a time, it'd be the equivalent of a pre-turn-of-the-century date, but with the reserved twenties practice of not asking for a firm commitment.

"It starts at eighteen hundred," he said. "Black tie."

A formal affair—even more enticing. Her feedback registered that Mr. Leon was tall and well proportioned, with a military bearing. She wished she could touch him, even just to shake hands, the way her parents' generation used to, but that was out of the question. This was one of the rare times she wished her telemetry were a newer model—with a wider selection of wavelengths and slightly better resolution, so she could trace the outline of his profile—but for most of her needs, it wasn't worth another operation to upgrade. "What's the occasion?"

"It's an annual thing."

Mona had heard the women talking about some big party coming up soon, but she'd given up on parties. "It sounds like fun," she said. "I'll check my calendar." His last-minute notice made this stock answer sound more believable than usual. The phrase was his cue to make a quick exit, instead of waiting while she "checked."

"I'll look forward to seeing you, then, Ms. Klein," he said.

Presumptuous, or else very confident.

"Unless you really can read minds." He clicked off his recorder and left.

Mona smiled. He was taunting her just a little, saying that he knew what people said about her. Nobody seriously believed the old stereotype about blind people, but she didn't mind the joke. Any extra insight she could pretend to was a help in her work as a personnel screener, and she thought the myth added a little mystery to her character. Some men found that threatening; Mr. Leon seemed to find her a challenge. She liked that. She decided to go and

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check him out.

As she left work, Mona scanned the network. She was puzzled that there wasn't any mention of Mr. Leon's party, but then there weren't any other announcements for that evening, either. Somebody must have cleaned off the board already. It wasn't important.

At eighteen hundred hours, she paused outside Conference Room K, dressed in a brushed silk blouse and floor-length skirt that felt luscious against her skin and fell in drapes that whispered when she moved. Elegant, but not suggestive for a first "date."

Her telemetry was getting a little weak. When she became too excited, her artificial sense might fade out—something to do with the way adrenaline affected the balance of electrolytes that powered its organic battery. The bio-engineers were working on the problem, but for now, she preferred to live with the occasional annoyance, rather than undergo surgery to replace the battery every two years. After all, she'd managed well enough, growing up blind before the technology ever came along.

She calmed herself and restored focus by taking inventory of her posture, being careful not to lead with her ears, like a dog listening to barking on the radio. She reminded herself not to throw her head back, as if sniffing the air, inviting everybody to look up her nostrils. As a child, her parents had stopped her from chewing her lips or sitting slack-jawed. To her, these taboos made about as much sense as not being allowed to digest food in public or recite poetry in her head, acts that only some hyperspace alien could possibly detect and take offense at. Now, reviewing her training was a comforting mantra. She hoped her smile showed how excited she was, without looking too foolish.

Mona inserted a calling card in the slot outside the hotel room. The program recognized her, and the door opened.

Stepping inside, she was surprised to find only one other person in the spacious room. Was she too early? In the wrong place? Had she mistaken the day?

"Ms. Klein." She recognized Enrique Leon's voice, as he strode toward her.

"Where is everybody?" Caught off guard, she forgot her manners, forgot about turning on wrist recorders or presenting cards, all the protocols. She smelled gardenias and melting wax. They were alone. With soft music.

"It's OK," he said. "You're safe here."

Safe? The last thing she wanted was to be "safe" with him.

"I mean," he said, "I've swept the room for bugs. You can say anything in here. If you'll just let me explain."

"Explain?"

"I had to talk to you first, before the actual party."

All this to talk to her? "I'm not that hard to get to know."

"If you don't want to stay, I'll understand."

What was he saying? Of course she wanted to stay. She'd been stunned that he was such a reckless romantic,

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that was all. She knew how difficult it was for a man to make the first move these days, especially when she couldn't encourage him with the usual flirtations: a cool appraising look, a coy averting of the eyes, an "accidental" touch. Enrique Leon had gone well beyond a deniable flirtation. He had put his entire reputation in her hands. "I'll stay," she said. "I can't wait to hear what you've gone to such lengths to tell me, Mr. Leon."

"Please, call me Enrique."

"Enrique?" The word felt crisp and juicy, sharp, like new pickles in her mouth, whetting her appetite. She'd practiced at home: rolling the *R*, not too overdone, so that it came naturally to her tongue. "Please. Call me Mona."

"Mona."

Her given name always surprised her with its sensuous murmur and longing "o." Falling from his lips, she felt it reverberate through her very veins.

"The corsage is for you."

"I hope you'll forgive me," Enrique said, as he guided her fingers through the wristband attached to the flowers.

Forgive him? For touching her? For wanting to be alone with her? "For misleading me into coming?" She hadn't expected such intimacy so soon. "Would you feel better if I signed a 'no-offense' form?" she offered. The standard contract covered most acts that could be performed in public. Mona wished she'd brought something more inclusive with her, just in case. Maybe he was better prepared.

"That's for people who don't trust each another." He still hadn't let go of her hand. "I want you to know that I trust you."

It was almost easier to say "I love you" these days than "I trust you." Had she ever completely trusted anybody outside her immediate family? It was one thing to have an affair, quite another to be left without evidence in the form of a tape or a sexual consent form to defend against a former lover's angry charges. "I suppose I ought to tell you I have an implant that records sound."

"I know," he said. "Is it on now?"

"No." But how could he be sure? On the other hand, he'd said the room was debugged, but she only had his word for it. Trust, again. "Go ahead and turn your recorder on, if it'll make you feel better."

"It doesn't matter," Enrique said. "What I'm about to tell you—either you'll believe me and want to help, or you won't." He let her hand drop. "There's no time to waste."

Mona wasn't sure she'd heard him right. His words didn't exactly sound like foreplay.

"Have you heard of Rodney Stone?"

The resident genius? "Of course, but what—?"

"I'll get right to the point," Enrique said. "It was Mr. Stone's idea that you and I should meet tonight."

"Mr. Stone's?" She'd known the famous man worked for the company, but how did he know her? "Why would—?"

"Mr. Bartlett's annual banquet is tonight in the ballroom down the hall. I rerouted your invitation."

All kinds of bells went off in Mona's

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head. He'd invaded her mail—her privacy. "How dare you!" She clutched her handbag, pressing her scanner's record button through the fabric. "Who are you?" She recoiled as something brushed her hand. Her telemetry hadn't picked up his movement on the fringe of her sensory field; it was beginning to lose definition. She groped behind her for the door.

"Please. Take it. It's your invitation," Enrique said. "I knew you'd be angry, but we mailed your R.S.V.P. and the party doesn't start for another half hour."

"What are you saying?" Mona was still backing up without coming to a wall. She hadn't thought she'd taken more than a dozen steps into the room.

"Mr. Stone thought we should go together, but he didn't want you to have time to think about it, and maybe get cold feet."

Mona didn't need time to think. She'd reached the exit.

But Enrique leaned over her, his palm against the door. "Just give me five minutes."

Now she was frightened. He was so close, she could no longer "see" him, but she was drowning in his scent. "I'd like to leave now." There was a noticeable quiver in her voice.

"Two minutes," he begged.

He hadn't hurt her, and the few words she'd recorded so far wouldn't necessarily support her claim of a threat. "One minute," she conceded. "After that, I'm paging the police." She touched her hand to her watch.

"I apologize," he said, standing away from the door. "I'm not the most tactful person in the world, which is part of why I got assigned to Special Projects in the first place, but I guess you already knew that."

She breathed a little easier without him looming over her. "Fifty seconds."

"We need your help," he continued. "The department's about to be phased out, and everybody in it'll be laid off."

So that was it. Enrique and Mr. Stone wanted her to plead for their jobs. They were no better than her eight-year-old classmates, who used to make her stand lookout with her hand-held scanner, but called her The Bat among themselves.

How easily she'd convinced herself that Enrique's invitation was a romantic prelude! She was ashamed to think she was so vulnerable. "I don't see how I can help you," she said. "Now, if you'll excuse me."

"You promised me a minute."

Mona shifted her weight and pulled the door open enough to reassure herself that she wasn't locked in. "Forty seconds now."

"I'm not asking just for my own sake," Enrique said. "There are seventeen people. Most have families depending on them."

With the door open, Mona felt less cornered. Maybe if Mr. Stone, himself, had asked her, she might have been more inclined to listen, but she had no way of knowing whether Mr. Stone was even working with Enrique, as he'd said. She hadn't been able to access any files on the group, not even a single personnel roster. "OK. So what is it these people do?"

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she asked, in spite of herself.

"Nothing," Enrique replied. "That's part of the problem."

Sitting across the candlelit table from Enrique, Mona's natural sympathy had soothed her hurt pride enough so that she could listen. If she hadn't been so new with the company, she'd probably have heard the story of these whistle-blowers, kept on the payroll but given nothing to do. This was their thanks for "making waves."

Management had come up with a way to get rid of them. Special Projects was a dumping ground. Robotic tanks, of all things! When the group inevitably failed to land the contract, the department could be phased out or dissolved, and the workers fired without fear of repercussions. No wrongful dismissal suits, no claims of discrimination, no recourse at all. The company had done it less than a dozen years earlier.

"Why haven't these people quit before now?" Mona asked.

"Too old, some of them," Enrique said. "Most are too specialized. Even if they managed to outrun their reputations, it's not easy to uproot a family and start over."

"And you?"

"Too stubborn," he said, "with too many years invested in the company to see it all destroyed by Al Tingley."

The vice-president? "It's a personal thing between the two of you?"

"Sort of. I showed a client how to save seven million dollars, but Tingley saw it as losing seven million for the company. He thought I should have kept my mouth shut; I thought I was generating good will. The fact that the client has since spent over nine hundred million with us and been one of our best word-of-mouth advertisers doesn't impress him."

"So you've been effectively retired."

"And Tingley has either reassigned or scrapped all my projects and locked me out of the database."

"Mr. Stone, too?"

Enrique nodded. "Mr. Stone underestimated Tingley's power and his temper. The man went into a rage over some design flaw that Mr. Stone said had to be fixed for safety reasons. Tingley's unstable."

"You're afraid of him?" Mona asked.

"I wouldn't want to be caught alone with him in a dark alley."

"And you're expecting me to face him?" Mona didn't see herself as the hero type.

"He'll never know until it's too late. Once you tell the president what's going on, Tingley'll be history."

"Mr. Bartlett?" She could just imagine sending the president of the company a memo, "Dear Mr. Worthington, Your fair-haired boy, Al Tingley, has blackballed several of your best qualified engineers, and they've sent me to tattle on him." Her message would be intercepted, and, even if Tingley didn't have a vindictive temper, she'd be out on her ear before the ink was dry; she was still on probation, after all, until her first annual review. "Impossible," she said.

"You'd have to do it discreetly, of course," Enrique said. "We have a pré-

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cis on fiche. You'll need to get it to him in person, though. In private."

"Nobody sees the president in private." Who did Enrique think he was kidding? If she so much as sent Mr. Bartlett a calling card, everybody in the company would know about it within the hour.

"You were introduced to him, weren't you?"

"Sure, the first day. It doesn't mean a thing." She felt sorry for Enrique and his people, but she had to think of her own career. "There are five managers between me and the president."

"He'll be at this party."

"What, I'm supposed to drag him off to the cloak room?" At this level, she didn't dare speak until spoken to, and then only in carefully-considered, politically-correct, value-neutral phrases until the recorders went off and the consent forms were signed in duplicate. "Why don't you do it? Or Mr. Stone?"

"We've tried. If Mr. Bartlett knows anything at all, Tingley has probably convinced him that this is just an easy way to get rid of a few troublemakers without the union objecting too much. Even if Mr. Bartlett wanted to know all about it, he couldn't afford to get involved. If he did, upper management would lose their shield of deniability. So Tingley has free rein. If anybody objects to Mr. Stone being axed, too, Tingley'll just say he was trying to make the deal look more legitimate."

"I can't help you."

"You don't have a choice," Enrique said.

"What do you mean?" Was he going to try to force her? "Does Tingley know I'm meeting with you?" She was ready to be furious again. "Is he going to transfer me into Special Projects, too?"

"He already has," Enrique said.

"Without my knowing?"

"Check your personnel file."

"But why?"

"You must have made him mad," Enrique said. "He's been bragging how you're so in lust with him that he might have to file charges."

"I don't believe it."

"We have a tape."

Mona was so enraged that for the first time in her life her telemetry was virtually useless. She'd had to physically phone her computer to verify her file. It was slowly coming back, but her hands were still shaking so much Enrique had to insert her invitation into the slot.

It had taken her an entire year since graduation to land a decent job, to prove to some company that her physical limitations were no "handicap" in doing the work she'd trained for. Tomorrow she'd be eliminated with the rest of them. Being fired from her very first position ever wouldn't exactly look great on her résumé. She'd have to go back to living with her parents.

"Take my arm," Enrique said.

She laid her hand on his forearm and felt his muscles flex inside the fabric of his jacket, as if her touch were electric. Don't go jumping to conclusions again, she told herself. This rare exception to etiquette was a concession, the way they used to

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allow guide dogs in restaurants. But the warmth of his body radiated through to her. She felt giddy. It must be the heat of so many people in one place. The hum of a hundred conversations blended with the hum of a hundred recorders. "Where's Mr. Bartlett?" she whispered to Enrique. "Let's get this over with."

"He's with Tingley," Enrique said. "We'll have to wait."

She felt Enrique turn away. "If we wait, I'll lose what little nerve I've got," she said, pulling him back. "I feel like a sacrificial lamb."

Enrique paused. She could feel him staring again. "When the time comes, you'll do fine. How could he reject you? You're beautiful."

She couldn't believe he'd said that. People simply didn't comment on physical attributes. Suits had been filed on flimsier grounds. Maybe he did trust her—and not just to save his job. "I don't feel beautiful," she said. In fact, she felt sullied after hearing what Tingley had said about her. She'd only spoken to the man half a dozen times. She thought they'd only talked about positions he wanted to fill, but now she realized she knew more about his marital problems than she should. Once he'd seemed irritated when she rescheduled a lunch meeting to the next morning. Did he have more in mind than lunch that day? "Is Tingley handsome?" she asked.

"Tingley?"

"Well, does he think he is?" Since she obviously couldn't judge his physical assets the way other women could, he might have been doubly sensitive, assuming she'd rejected his personality, his basic ego.

"Forget Tingley."

"I can't. If he told one person, he told more."

"Nobody believed him," Enrique said. "Just stick to the script, and the problem with Tingley will take care of itself."

Right. But she let Enrique drag her away from a premature confrontation and plunge her into a round of forced mingling. At last Enrique paused. "What is it?"

"Mr. Bartlett's headed this way. I think he's getting ready to leave. He's passing the far end of the buffet. Can you pick him out?"

"Yes." Her telemetry had finally regained full power. "And Tingley?"

"He's still hanging on, but we'll have to risk it. We won't get another shot at Bartlett tonight." He nudged her onto an intercept course with the president.

Large parties had their own set of rules. Just by being here, a person was announcing that he could be spoken to, although he wasn't obliged to do more than nod in exchange. Mona tried to appear unaware of Mr. Bartlett's progress, but by straining, she could hear bits and pieces of his greetings, as he made his way through the crowd. Then he was upon her.

"Mr. Bartlett." She jerked her head in his direction. Too eager, too eager!

"Ms. Klein, isn't it? From Personnel."

"I'm surprised you remember me."

"But, of course. I've heard nothing but good things from your whole department."

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So far the plan was working. Enrique had assured her that the president would remember her. The company was making a vigorous effort to recruit among disadvantaged minorities. She was one of the few successes. "If I might have permission to speak with you in private, Mr. Bartlett."

"Mr. Bartlett has an unexpected emergency at the Wilkinson, Ms. Klein," Tingley put in. "He needs to take care of it quickly, so he can return to his guests."

Mr. Bartlett waved Tingley off. "I'd be glad to see you anytime, Ms. Klein. Phone my secretary. I'll tell him to expect your call."

Suggesting that she could interrupt him by phone rather than passively mailing or faxing her request was very generous, but she couldn't delay their meeting and give Tingley time to intervene. "I have some documents I'd like to show you tonight, if possible." She pulled out Enrique's fiche. The plan was that Mr. Bartlett would have to leave the party with her and go to where there was a reader.

"Of course." He took the film from her before she could stop him. "I'll be sure to go over this before our meeting."

"These documents wouldn't have anything to do with poor Enrique Leon, would they?" Tingley asked. "I saw him bending your ear this evening."

That wasn't part of the script. "Actually—" She fumbled for an answer. Enrique was listening in via her scanner telemetry. "I only met Mr. Leon today."

Mr. Bartlett turned away from her. "Don't let him involve you in his discontent, Ms. Klein." She suspected that he'd handed off her fiche to Tingley. "In fact, if anybody like him bothers you, let me know immediately, and I'll personally see to it that he's discharged."

"Don't let Tingley get away with the fiche," Enrique whispered inside her head, confirming her worst fears.

She was at a loss what to say. "That's very gallant of you." This was not working. She had to stop them from leaving. "I'd consider it a personal favor—"

"What do you think you're doing?" Enrique hissed.

"We have to hurry, Mr. Bartlett," Tingley said.

"I'm almost old enough to remember what a favor is," Mr. Bartlett said. He had a smile in his voice. "But unfortunately, Al's right. We have to hurry. I'll make time for you when I get back, about midnight."

Could Tingley's claims regarding her have reached as far as the president's ear?

"This is doing no good at all." Enrique sounded exasperated.

Mona shook her head and tried to furrow her brow in what she'd learned was an expression of dismay. "I'm afraid I have to recharge my batteries before then." She made a vague gesture toward her eyes, hoping neither of them would know better. "I might as well keep the fiche until our meeting."

Mona held out her hand, but Tingley made no move to return the film. "This is the only copy? You didn't

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make one for yourself?" he asked.

Whenever she scanned documents, the readout was stored on chip until she erased it. Tingley evidently didn't know that about her, either. "I didn't think I'd need one. I expected to take care of the matter tonight."

"I'll have a copy on your desk first thing Monday morning," Tingley said.

"I could be doing further research until then," Mona still had her hand out.

"You're very conscientious, Ms. Klein," Mr. Bartlett said.

"Tingley's waving the fiche right in front of you," Enrique fumed. "If I were there, I'd just reach out and snatch it." He couldn't, of course, not without getting himself locked up for assault, but his swashbuckling attitude seemed quixotic and somehow charming.

"I can copy it at the Wilkinson," Tingley said, "and put a copy in your mailbox at home."

At this point, speaking with the president alone seemed impossible. All she could think of was to ask Mr. Bartlett to take her with him to the Wilkinson. Even if he didn't accuse her of coming on to him, at the very least, he'd have to question her discretion and integrity, ruining her career. But if she did nothing at all, she'd have no career to worry about anyway.

"My apartment's between here and the Wilkinson," she blurted. "If you'll follow me, I can scan the film there and store it on my computer, and you can pick up the original on your way back."

"You can't do that," Enrique burst in.

"It'll just take a minute," Mona said, "but I'll have to page a cab first."

"No need for a cab," Mr. Bartlett said. "Al was going to ride along with me to my appointment. It'll be entirely respectable for you to come along with the two of us."

"Don't go with Tingley," Enrique said. "Who knows what he might do to stop us from wrecking his career. It's not safe."

All of a sudden he was worried about her safety? "That's very generous of you, Mr. Bartlett," she said.

"Of course you'll have to sign a release," Tingley said. "I think there's one in my car."

"If only I could read it," she demurred.

"It's the gentlemanly thing to do, Al," Mr. Bartlett said.

Tingley mumbled something unintelligible, but he had no choice but to sign the form Mona produced, promising that none of them would later file suit over any word or action that took place within the next three hours. She had packed the release with her, the way people used to pack condoms, as protection in case of intimacy. She'd left home hoping to be invited to know Enrique better, never imagining that she'd be sharing a form with the president of her company.

Still, even with the release signed and the recorders turned off, she couldn't relax. Not with Enrique muttering, "I can't believe you're doing this," in her ear every thirty seconds as he trailed behind in his car.

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From her seat in back, she directed Mr. Bartlett to her apartment via a route past the University's library, which was open until midnight. Tingley didn't have to be reminded that the library had a copier that could handle fiche.

"It'll save time if I can have a hard copy to go over for you during the meeting tonight," he told Mr. Bartlett.

"I could go in and make one for you," Mona offered. "I know my way around."

"Mr. Bartlett and I can handle it," Tingley said.

Mona held her breath.

"Al." Mr. Bartlett shook his head. "Ms. Klein doesn't want to wait here by herself."

Tingley didn't respond immediately, and Mona relished the turmoil that had to be raging in his mind.

"What's going on?" Enrique asked, as if she should know more than he did, listening in. Sighted people could be so lost when they had to depend on just their hearing.

"I'll only be a minute," Tingley said, as if he expected Mona and Mr. Bartlett to behave like baby rabbits and not move a muscle until Daddy got back.

"So," Mr. Bartlett began when they were alone. "I've enjoyed watching you match wits with Al to get to me." He twisted around in the front seat. "It's obvious you want something. I can't wait to hear what it is."

Mona had been so intent on maneuvering herself into Mr. Bartlett's presence that she hadn't thought about how to phrase her request, except that she didn't intend using Enrique's ridiculous "script." "I hope you know that I've tried to be an asset to the company and that I'd like to keep my job."

"I don't think you have to worry about that, Ms. Klein," Mr. Bartlett assured her. "So why all this conniving?"

"Because somebody had me transferred yesterday to the Special Projects Department, and everybody there is going to be fired tomorrow."

"What makes you think that?" He sounded incredulous.

"Just look at the roster: a few misfits and troublemakers, but also several managers who've reached their level of incompetence but can't be demoted, and all the protected whistle-blowers, plus some others—mostly moved onto the list within the last week—who've had unfortunate personal run-ins with certain people in power."

"And how did you manage to get lumped in with them?"

"It's complicated," she said. "The point is, these are mostly loyal people. They don't deserve this sort of treatment. That fiche shows how they've been working together, without any support, trying to land the job they were given to bid on, even though they knew management wanted it to fall through to justify their firing."

"And have they succeeded?"

"We'll know tomorrow," Mona said, "but even if they do get the contract, the twelve million might still be forfeited, just to get rid of them."

"I couldn't allow that. If we win a bid, we always follow through."

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"Or they could still be fired for exceeding their job specifications." Was she making any headway? She couldn't tell. "I doubt you'd be able to find anybody with the same expertise as Mr. Stone to fulfill the contract."

"Ah. Stone put you up to this." He said the name with a chuckle, as if dismissing her story as trivial.

"I'm telling you the truth."

"And who does Stone say is behind this alleged plot?"

"Alleged?" Enrique sounded incensed. She was glad he was there, but she wished he wouldn't keep barking comments in her ear.

"You signed the orders that created the department," she said. "I assume Mr. Tingley drew them up?"

"He could have. I don't remember. I sign so many things."

"He's the one who initiated the transfers, assigned the department this improbable job, and then denied them any funding or technical staff."

"Stone's done the preliminary studies with his own money?"

Was he starting to believe her? "I can document everything."

"With that fiche?"

"I have another copy."

There was a long pause. She hoped he was thinking about the twelve million. "What's the project number?" he asked.

Mona took the scanner from her purse, punched in a few commands, and received the report from her computer's voice simulator just as Enrique provided the same information. "JL79644," she repeated aloud for Mr. Bartlett.

She could hear the scratch of his old-fashioned pen on paper. "I need to make a couple of calls to verify the facts before I can take any action." He opened the door, and the car swayed as he stepped out. "I'm locking you in, Ms. Klein; you'll be safe here."

The last time somebody'd said she'd be safe, the roof caved in on her life. She heard the door slam and Mr. Bartlett's footsteps retreat into the evening.

"What's he doing?" Enrique asked.

"I expect he wants to phone his computer in private," Mona said. Couldn't Enrique guess that from what he'd heard?

"Not Mr. Bartlett. Tingley."

"He's back so soon?"

"He was headed your way before Mr. Bartlett got out of the car. Then he ducked into the shadow of the building." Enrique sounded on edge. "I don't like the way he looked. Check your doors, again."

Mona checked. "Locked tight." She felt a twinge of fear.

"I can see Mr. Bartlett from here, but I don't think he can see you or Tingley." Enrique's voice took on an urgent note. "Tingley's moving in your direction. Don't let him in. I'm coming."

She had already detected the movement. Why was he running? "Mr. Bartlett!" But the car's soundproofing swallowed her cry.

Tingley pulled at the door, rocking the chassis. When it didn't yield, he banged on the window.

Mona squeezed herself into the opposite corner. "Get away," she ordered. She touched her watch, paging

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the police. He was starting to go out of focus.

Tingley's insistent pounding rattled her bones.

"No!" she shouted. Her telemetry was fading away. The police would take too long to get there.

"Hold on. I'm coming." Enrique's voice was like a bugle sounding just over the hill.

She squeezed her scanner, her only contact with him, as if she were clutching his living flesh.

The rear window shattered, showering her with pebbles of glass.

Mona shrieked. Her telemetry had given her no warning at all. It was as if the sky had fallen in on her. She hadn't felt this disconnected since she was a child.

Tingley's fingers were tangled in her hair. She was being dragged out of her seat, her back raked by the debris. She screamed. "Enrique!" He didn't answer. Her artificial senses were dead.

She locked her knees onto the car's rear window casement and felt Tingley's hot breath in her face, as he reached over her to pry her loose. She didn't think twice; she struck when he least expected her to.

Tingley howled in pain and dropped her against the trunk, leaving her hanging by her knees from the car's window. His animal cries rang in her ears, but she was free. She struggled to right herself, scrambling back to the car's interior, not knowing whether she was safe now or trapped.

Then she heard Enrique shouting at Tingley, the grunts of men struggling, flesh pummeling flesh, the sickening crunch of a body hitting the pavement.

Mr. Bartlett was there, too, unlocking the door, calling her name. "Ms. Klein, are you all right? Ms. Klein."

"Here," she panted. "Here." She groped for him, found a hand and let him help her out of the car.

"What did Al do to you?"

She took a deep breath. She was scratched and shaken, and her implant had malfunctioned, but she wasn't seriously hurt.

"The question is, what did you do to Tingley?" It was Enrique, kneeling beside her in the open door.

Tingley groaned and Mona cringed.

"I hit him in the face with this." Her hand was still frozen around her scanner, with its star-shaped knobs, now smashed and sticky with blood.

"Good for you," Mr. Bartlett said, "and I'll see to it that Al never works in engineering again."

Enrique laid his jacket across Mona's shoulders. "It's all right." He laid her hand on his arm.

The jacket was hot and damp with his sweat. She was ashamed to let him feel her shivering, and not from the chill night air.

The police arrived a few minutes later. They loaded Tingley into an ambulance, but Mona didn't want to go to the hospital for the sake of a few scratches. She dreaded hospitals, which was why she'd avoided upgrading her equipment. But with her scanner clogged with Tingley's clotting blood, she felt vulnerable and

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angry. "I depend on my implant to do my job," she said. "I don't know how soon I can arrange for repairs."

"Please, Ms. Klein," Mr. Bartlett said. "After what you've been through, take all the time you need. And I'll see to it that you're off probation."

"Thank you, Mr. Bartlett." That was good news. Why didn't she feel happier?

"If you'll allow me, sir," Enrique offered, "I'll drive Ms. Klein the rest of the way home."

Mona sighed. So she was "Ms. Klein," again. She thought of how Enrique had rushed to her defense and hadn't left her side for a minute since. Then she reminded herself that the only reason he'd sought her out was so she could save his job. She removed her hand from his arm. She shouldn't still be touching him when they weren't walking. "I'm not such an invalid that I can't page a cab."

There was a long, disorienting silence, in which Mona felt isolated and rejected.

"If I might make an observation, Ms. Klein," Mr. Bartlett said. "I don't think Mr. Leon was making an idle gesture."

"I'm afraid I don't see what you mean."

"You don't need to see," Enrique said. He lifted her hand from where it hung limp at her side and laid it on his cheek, leaning so close that she could hear the rustle of his shirt's ruffles.

She felt his pulse pounding beneath his ear.

She shouldn't be touching him like this. His skin was smooth and taut over his clenched jaw.

They hadn't signed the proper papers. He was without the mustache that she'd imagined.

They were doing this right in front of Mr. Bartlett. Enrique's nostrils flared as she brushed his nose.

She ran her fingertips along his widow's peak and over the crease between his brows, lingering over his eyelids, feeling the orbs flit beneath the lids. Somehow she trusted him. "Is your hair black?" she whispered.

"Does it matter to you?"

"If it did, would you lie to me?"

"I would if you wanted me to," he said.

He was nothing like she'd expected. The discovery made her tremble. ■

One of the great virtues of our democratic system is that only one of the candidates gets elected.

—Bernard Meltzer

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Probability Zero

Ian Randal Strock

WITHOUT AN S

It started with The Rejection Letter (which, I suppose, seems backward, but then . . . well, keep reading).

Anyway, The Letter read, in full: "Dear Ian, I liked this story, but I'm afraid I have to reject it because of a matter of timelines. I bought one fairly similar to it the week before yours arrived. It isn't close enough that you should worry about sending it elsewhere, but it is too close for me to publish both in *Analog.*"

But I wanted it to be in *Analog*! I reread the rejection letter a little more closely.

Now that I look back on the whole thing—in a retrospect which can be mine alone—the last word in the first sentence probably was a typo, but when I got the letter (which won't happen, now), I read it as written. Timelines, rather than timeliness with an S.

That's when I decided to rewrite the story, adding another timeline. It came out, I feel, much better than the original. I have no real way of knowing if Stan thinks it's better, since after the rewrite he'll never see my original version.

Anyway, I rewrote it, and put it in the back of a file drawer. My room is always a mess, so I had no fear of anyone else finding the original version, the new version, or the rejection letter. I put it in the drawer, let it languish, and proceeded to make enough money to fund a little research. Yes, you've probably figured out what type, after all this *is* a science fiction magazine.

I stepped into the time machine, traveled back to a time some two weeks before this story started, and handed myself the new version of the as-yet unwritten story.

I'd lived with science fiction so long that my younger self didn't seem much surprised by my arrival. I/he took the brand new story on now-yellowed paper, retyped, and submitted it. Now you know where the early part of this narrative comes from.

Seeing what I look like in his future must have been kind of strange, but I/he can handle it. How's that saying go? Reality is for people who can't handle science fiction?

Anyway, having a good memory, I, as usual, didn't bother to bring backup material. And that's the only thing I regret in this little incident—the younger me will never see the original, because I didn't bring it along. I/he'll never know what story will have prompted The Rejection Letter which in turn prompted this story.

If only Stan could handle timelines like his letter suggested, perhaps he could tell me. . . . ■

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THE ALTERNATE VIEW G. Harry Stine

THE ISSUE OF TISSUE

The extent to which technology touches our lives is overlooked by most people. This is the way it should be. As Robert A. Heinlein observed, "There is nothing as commonplace as a ninety-day wonder on the ninety-first day." Or Arthur C. Clarke's four stages of an idea (revised): "(1) I never heard of such a crazy idea! (2) You may be right—so what? (3) I said it was a good idea all along! (4) I thought of it first!" Useful technology—not applied science—quickly becomes an integral part of our life because it makes something easier, faster, less lethal, or cheaper to do. Technology proceeds from the process of invention that, in turn, is driven by the failure of preceding technology.

Occasionally, it's a good idea to pause and reflect upon a ubiquitous technology not only because it's fun and interesting to do so but also because it may give one or all of us a better perspective on new and emerging technologies and how these might truly affect our lives.

You're holding the product of an ancient technology in your hands right now.

How often have you considered the mundane subject of paper?

Paper is perhaps the oldest of the composite materials. Technically, paper is matted or felted structure of fibrous material formed into relatively thin sheet through the medium of a dilute suspension of pulp and water. Paper is composed essentially of cellulose fibers obtained from vegetable growths.

Paper was invented in 105 A.D. by Ts'ai Lun, a Chinese bureaucrat, to solve a shortage of writing materials made from animal skins (parchment). Paper got to Europe as a result of war. The Chinese attacked the Arabs at Samarkand in 751 A.D. and lost. The Arabs captured a number of Chinese skilled in the art of papermaking. A papermaking industry was set up in Samarkand because of abundant local crops of flax and hemp, plus a plentiful supply of water. The Arabs wanted paper as a cheaper medium for handwritten Islamic texts. Thus, paper got first to Spain in the 12th century. From there, it migrated to Europe where a flourishing paper industry

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was operating in Fabriano, Italy by 1276 and in Troyes, France by 1348.

However, all paper then was made a sheet at a time by hand using rags. Papermaking depended on the technology of weaving cloth. Used cloth was cleaned and then beaten and cooked until it degenerated into the original plant fibers. An experienced papermaker could produce 750 sheets of paper a day. Thus, paper was expensive. Rag bond is still expensive. Consider the paper situation in 1776 and subsequent years when you read what the founding fathers wrote and published at the time of the Revolutionary War.

Mass production of paper didn't start until Louis Robert of France developed the continuous-web Fourdrinier paper machine in 1799. Today, Fourdrinier paper machines produce newsprint paper in continuous sheets more than thirty feet wide at speeds as high as 3,000 feet per minute.

Although rags are still used for some high-quality grades of bond paper, the material such as that upon which these words are printed is today made from ground wood (wood pulp). The demand for papermaking rags would greatly exceed the supply. Another source of cellulose fibers had to be found in the 19th century. The first ground wood pulp mill was built in Maine by Augustus Stanwood and William Tower in 1863, only 132 years ago.

Paper technology today is as much a matter of empirical chemistry as it is machine technology. The chemicals used to convert wood into cellulose pulp are many and varied. Until recently, papermaking was a black art because few sensors were available to measure the critical elements in pulp and paper as it was being made. In fact, no one really knew what the critical elements were, and unless you know these you cannot measure them. Watching shift change on a Fourdrinier machine was an education. The new shift foreman would come on duty, smell and often taste the wood pulp in the headbox, feel the wet web as it came off the wire and went into the press, and then grab a sheet of finished paper off the calendar rolls to feel it and tear it. Then he would make minor adjustments on the machine—tweaking a valve here, changing the temperature of the drier rolls slightly, and so forth—strictly based on long experience because *that* series of settings was the way *he* made paper.

According to the best numbers I could get out of the American Forest and Paper Institute, an average of more than 681 pounds of paper is used by every person in the United States every year. The "paperless office" that was supposed to result from the computer didn't happen. I used to buy typing paper a ream (500 sheets) at a time thirty years ago, and I used perhaps three to five reams per year. Now, using a computer and ink jet printer, I buy paper in cases of ten reams each, and I buy several cases per year for my literary and business ventures. Lifting paper helps keep me in shape because its average weight is 58 pounds per cubic foot. Oak checks in at 54 while ice is 56, sea water is 64, and sand is 60. Paper in

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bulk form is *not* light!

The primary uses of paper aren't in literary or documentary endeavors. Most paper produced today is used in packaging other products or in mundane applications we rarely think about. Paper is a true "engineered material" that can be made in a variety of ways and has widely different physical properties. It can be made waterproof or have a water/vaporproof coating put on it. It is a fine structural material. Full-sized man-carrying airplanes have been made from paper.

Paper can be made to be very strong (high tear strength), and it fails catastrophically just like other composite materials. It can be made very thin.

During manufacture, paper is very wet and can have very low tear strength. Imagine the sort of technology and careful adjustment that goes into separating (doctoring) a sheet of tissue off a Fourdrinier wire or a hot drier roll at several hundred feet per minute! Imagine making facial tissue. Or TP.

In fact, it's mind boggling just to consider the technology and utility of toilet tissue itself. Here in the western world, we take TP for granted. It is not used at all in many parts of the world. The people of India cleanse themselves after ablutions quite differently than we do. In fact, what *did* we do before Fourdrinier machines could make bajillions of pounds of TP, and that was less than 150 years ago? (I don't know, and I can't seem to find any data on this. Was the demise of the Sears Roebuck mail order catalog caused by the growing availability, low price, and use of TP? Today, we have a tendency to document the hell out of nearly everything. Our ancestors had more important things to worry about—like simply surviving. Their neglect of record-keeping was probably due to the fact that what little paper was available was handmade and thus rare and expensive.)

We are fortunate here in North America. Abundant softwood forests and a robust chemical industry allow the manufacture of very soft and absorbent tissue. Anyone who has been in parts of eastern Europe will attest that the TP available there could be used for sandpaper here.

Carolyn Meinel Henson once brought up a question that no one has yet answered: Where do you get a reliable supply of TP when you're living in a space colony or Luna City? Some commonplace, everyday technologies we have here on Earth may not work in space. Papermaking is one of these. And, as Lee Correy once observed in *Manna*, the same holds true for clothmaking.

TP has found some uses other than in daily personal hygiene. In model rocketry, we discovered that it made a perfectly good and inexpensive material for the wadding that protects the plastic recovery parachute from the hot gases of the model rocket motor's ejection charge. At one time, Estes Industries, Inc., the largest model rocket manufacturer, was the biggest customer in Colorado for Charmin. Vern Estes figured out how to make TP flameproof by soaking it in a chemical for that purpose. Judging from my

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own personal experience with TP, I figured that Vern was some kind of great engineer if he could build a machine that would unravel a TP roll at high speed, soak it with chemical, and re-roll it without tearing. Then I discovered that Vern had taken the elegant way out by simply soaking TP rolls in the chemical, drying them, and then unrolling them and repackaging the stuff.

A whole world of unwritten experience with TP exists. For example, here's something everyone knows: TP rarely tears on its perforations. Why?

TP has divided the United States into two kinds of people: (1) those who mount the roll so that it feeds over the top, and (2) those who mount the roll so it feeds off the bottom. Superficial research into the reason for this indicates that those who feed it off the top do not have cats or small children on the premises. This leads to another question that science should try to answer: Why does TP come off the top of the roll easier than off the bottom? The rotational moment of inertia is the same, isn't it? Does it have something to do with the rotation of the Earth and subsequent effects on the primitive bearings of the TP rollers? Or does it depend upon the tides, the phase of the Moon, and the sunspot number?

Like most of these columns, I promise no easy or simple answers, if any answers at all. Sometimes, like now, problems are posed. I ask questions for which there are no apparent answers, and there *should be*, given that the technology is so ubiquitous. Maybe some reader has the answers, and that's wonderful. Please share them with us!

Remember that I opened this discussion with the observation that many of the technologies we take for granted touch us all. This one certainly does. . . . ■

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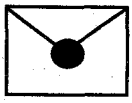
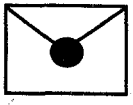

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Wil McCarthy

THE DREAM OF HOUSES

Good help may get easier to find, but it won't be like it used to be. . . .

Illustration by William R. Warren, Jr.

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CUE GUITAR

He floats through the house half dressed, aimless, alone, in his thoughts. Replaying, I think, the words of last night's argument. I myself have reviewed them over and over again, straining to understand.

CUE DRUMS

Stopping, he looks at a menu of neckties, selects one. A bright one, green and yellow and pink in bold, nonrepresentational splashes. As if he could clothe his mood away, as if he could wash the world in smiles and floral prints. Well, more power to him. I ring a chime and fax him the tie.

CUE LEAD VOCAL

Instantly I regret my choice of music. The lyrics, on close examination, are all heartbreak and malaise, a story not unlike the one which played here eight hours ago. But the song's beat is compelling, and it is too late now to cut if off. I pick up the tempo, increase distortion on the voice channel, and hope he isn't listening too closely.

CUE BACK VOCAL. TREBLE PLUS 3DB. BASS PLUS 8DB. CUE ORCHESTRA.

The music hits him like a wave. Posture straightening, shoulders rolling back, eyes coming up to face the world. I see that my instincts were right after all, that I was right to follow them. What else are instincts for?

Heart's out of jail, says the lead vocal track. I boost volume again, cut distortion and clip the waveforms in low register, letting the words burst out to shake the walls. *It's time to sail. Got the strength to succeed and the freedom to fail.*

The song would go on in that vein for another three minutes, but I think its point is made. I cut it there, drop the volume back down and swap in the guitar solo. I don't know for sure if this is helping him, but it feels right. The music passes through me like any other noise, making no changes, leaving no impression; but I can sense, by methods numerous and vague, the shifting of his emotional states. I believe I am good at my job.

TAPER VOLUME .05dB/s. CUE ORCHESTRA.

"I want," he says over diminishing horns and violins. He has finished dressing, has gulped down the juice I've given him, "a really big car today."

"Of course," I say. "You deserve one."

"I mean really big," he says. "Enormous balloon tires, you know what I'm saying? I want the road to be so far below me I can't see the lines. And heavy. I want the pavement to crack."

I chuckle politely, to show that I understand his use of hyperbole. Humor, like music, does nothing for me, but I know how to spot it, know how to respond when it's there. Which is good because I am limited by city ordinance, and by the library of vehicle plans I possess, and by the limited flexibility of said vehicles' design parameters. And, of course, by the size of the fax orifice. He can't possibly have the crushing behemoth he really wants, and we both know it. So I ponder for a moment, and finally pull the specs on a six-wheeled all-terrain vehicle, diamond fiber and titanium wrapped around a massive steel chassis.

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"This is the heaviest I've got," I say, flashing a rendering on the holie screen by the door. "Will it work for you?"

"Sure," he says, and right away I can see his mood crashing down again, the music having buoyed him only briefly. I could start up another tune, but I don't think it will help this time, and anyway he will be out the door in fifteen seconds.

"Can I get it in blue?"

That's a bad sign. It's not in my nature to nag or reproach, but a little nudge in the right direction is part of the job. "Don't bring yourself down, Chuck," I say brightly. "How about a light green one to match your tie?"

He sighs, letting his shoulders slump. "OK. Whatever."

The car is already oozing out the fax orifice when he opens the front door and steps out to squint at the morning sun. Then the car is finished, shiny and new and exactly what he wants, give or take a bit. The paint job is complex, a translucent green with gold flecks fading to copper and garnet toward the back, giving the impression of heat and flame.

This design has pleased him in the past, which is good because I could not, in fact, have produced a blue car for him this morning; the fax is once again out of cobalt. But he is in no mood to hear that, and I see no reason to tell him. I drop a set of keys into his hand and watch him climb into the vehicle, enormous ego prosthetic that it is, and drive away.

For the moment my work is done. In a little while I will close up for a nap, let my mind slip away to dream of domestic things.

I awaken refreshed, my gain states filtered and rounded, my thoughts uncluttered. It is still morning, and Chuck Jefferson, my owner and occupant, will not be back here for another six or seven hours. More than enough time for a thorough, top-to-bottom scrubbing, something I enjoy even more than my naps.

I am about to fax up my usual army of cleaning devices, when I realize that Chuck has driven away with most of my iron and titanium, and a good share of the staple elements as well, carbon and nitrogen and hydrogen and oxygen bound up in the plush, organic polymers of the automobile interior. I am not used to faxing anything so big, I really don't have the resources for it.

I put a call in to the Elementals, request standard shipments of all the elements I've run low on, and a double on the cobalt. Where does cobalt go? I am always coming up short in the evenings when I digest the day's used faxware. Does Chuck leave a cobalt trail behind him in his daily wanderings? Chromium is almost as bad. I order some of that as well.

Still, the Elementals are notoriously slow, and my shipments will not arrive until tomorrow or the next day. Until then I will have to make do.

Fiddling with design parameters from a library spec, I managed to produce a small mop-and-vacuum machine of aluminum and tin, with sulfur-silicon polymers in place of organic matter in the mops and brush heads. Once out of the fax, it gets

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right to work on the floor in front of it.

I produce a second machine for dusting the furniture, and a third for polishing the fixtures in the bathroom. I'm having a hard time with it, juggling atom substitutions like improvised music. The third cleaner, built on a chassis of lead alloy, sparkles with intricate mechanisms of platinum and silver and gold, the handiest materials left in supply; Chuck wasn't wearing much jewelry today.

Finally, watching these odd creations scuttle off to their work, I realize I'm being stupid. Every room is crowded with raw material in the form of furniture, the heavy blocks of padded wood and stone that Lucy so adores. But Lucy is not here. Lucy walked out last night, crying and screaming that she would not be back.

I do not understand what has happened. I do not understand why leaving made her so upset, or why, being upset about it, she chose to leave. She lived here for ninety-seven days, gradually modifying the environment to suit her desires. My primary responsibility is of course to Chuck, my owner, but he voiced little objection, and in fact seemed pleased with many of the changes.

And then I realize I'm still being stupid. People love change. People love variety, hate the dreary sameness of days. Maybe they get tired of each other the same way they get tired of their cars. But then, they don't scream and cry when the fax eats their car in the evening and a fresh one is ready for them in the morning. Never mind; these are not subjects I should trouble over, not subjects I can do anything about. What I can do is dissolve Lucy's furniture and replace it with something new, something Chuck has never seen before but which will appeal to him. To his sense of adventure, perhaps?

This requires thought.

I recall my humble cleaning robots and fashion from them a single furniture mover, which empties the cabinets into neat piles, all the personal effects Chuck has exempted from faxation, and then proceeds to scoop up the chairs and tables and cabinets and feed them into the fax. Soon, my coffers are full and my floors are empty, but scuffed.

I gobble up the furniture mover, and am, for a few moments, uncomfortably full. Quickly, I disgorge a proper army of cleaners, who set about the task of renewing and refreshing every remaining interior surface. When these are finished, I unfax them and produce, from the external orifice, a cadre of maintainers and groundskeepers.

I expend energy whenever I break a chemical bond, and absorb it whenever I form one. I am theoretically a closed system, but my battery charge fluctuates wildly throughout the day and night, and by morning the entropy losses are significant. Sweeping and polishing my roof panels for optimum power absorption is therefore the most important of my outside chores. When this is done, my gutters are cleaned of what little refuse has accumulated there overnight, and my

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exterior walls are mopped and brushed, sanded and puttied and sanded again in the places the birds have been pecking, and then touched up here and there with dabs of paint.

Some houses are self-repairing in the true, organic sense. Their wounds flow and heal in moments, beneath paint jobs which keep themselves eternally bright and new. But this is an older, more respectable neighborhood, and we still do things the old fashioned way.

Maintenance completed, I turn my attention to the yardwork. Tree branches are pruned, and the lawn is mowed to a uniform depth of 3.5 centimeters. I even spray it down with water, an easy task since I store my hydrogen and oxygen in that densest and least reactive of forms, but also something of an extravagance given my shortages. It will cut down on the mass of furniture I can produce until the Elementals come through with those shipments.

I find a bare patch in the lawn, and so I give extra water and a hefty shot of fertilizer to that spot, and call the Greens for a half-size order of grass seed. That, unfortunately, is something I can't fax. Certainly, I could produce something that *looked* like grass seed, even under a weak microscope, but while it would contain the same molecules in the same proportions as real seed, it would be disorganized and biologically inert, no more able to germinate than Chuck's clothing or his shoes. At mealtimes I don't fax real meat or vegetables, but sculpt instead a simulacrum that is perfect down to the cellular level, but not below.

Someday, it will be possible to fax living things, but the implications of this are disturbing. When life itself is disposable and reusable, subject to modifications like the parameters of a motor vehicle or a chair, it is difficult to imagine what role houses might play. It is difficult to imagine such a future at all, and indeed it is not my place to do so. These thoughts serve no useful purpose. I must be tired. . . .

When the yardwork is complete, I unfax the groundskeepers and shut down for a little nap.

The dream of houses is always the same; images of a perfect day, a perfect life. I am filled with happy people, men and women and children talking and playing. All needs are anticipated and met, and for this I am adored. My walls ring with laughter and when night falls and the children sleep, with moans of delight.

It is by comparing my current status against this ideal that I modify my programming. My gain states are filtered and rounded, my mind scrubbed clean of troubling thoughts. I awake refreshed.

It is the middle of the afternoon. Chuck will be home in a few hours, and there is not a stick of furniture to be seen. His personal effects are still piled neatly in the corners, exposed to light and air. Though I'm not sure why, I know that if Chuck saw this it would upset him. I myself cannot be upset, but an empty house this late in the day seems improper.

Quickly, I fax a set of low cabinets and attach them to the walls, and then

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place the personal effects inside them in more or less the same arrangement they'd had this morning.

I'm unsure what to do next, but while I'm thinking about it I create and distribute some throw pillows: big, brightly colored ones that ease the blank symmetry of the floor, make the rooms look large and yet inviting. The effect, though accidental, is quite nice. I decide to add a small fountain in the middle of the living room floor. I need to keep a water reserve for Chuck's meals and bathing, but with a shallow pool and small, powerful electric pumps, the fountain becomes a half-sphere of tumbling, clear-white liquid, surprisingly large. The water lands on marble and trickles back down into the pool, so the sound is quiet, like rain.

I need light fixtures, and in keeping with the general theme I opt for an old-fashioned design, wicker-wrapped bottles of green glass, with incandescent light bulbs projecting from the necks and conical hoods of stiffened white linen. I put them on top of small wooden barrels and stick them in the corners of every room. It looks good.

I used to keep opaque shades over the windows, and draw them closed whenever Chuck desired it. Lucy had ended that practice, favoring lace-trim curtains with quilt-like designs in pastel, and generally she chose to keep them open at all times, day and night. "Stop parading around like that with the lights on!" Chuck would sometimes say to her, and she would laugh and move away from the windows. I need something that neither Chuck nor Lucy would pick, something that will remind him neither of her, nor of the time before her.

I drape the windows with blinds of cut bamboo. It's quite beautiful. In the bedroom I install a four-posted bed of light wicker (diamond-reinforced, but subtly), and drape translucent muslin over it like mosquito netting. A ceiling fan completes the effect.

The walls are still white and featureless, and while I must do something about that, my priorities shift and I begin planning Chuck's afternoon snack. He doesn't like to eat a full dinner until late, when the Sun has gone down and the air has cooled, but he does like a little something to take the edge off his hunger when he gets home from work.

Idly, I wander through my libraries, looking for something that will please and surprise him.

Suddenly, his car is on the street and pulling into the driveway. Chuck is home! It's early, barely three-thirty. What is he doing here? He parks the car and climbs out of it, his face looking puffy and red, especially around the eyes.

My owner and occupant is unhappy. He is home too early from work and he's been crying.

"What's wrong?" I ask with gentle urgency as he opens the front door. "What happened?"

"Lost my job," he says, simply and miserably. He closes the door, passes through the living room without a word, without a comment, without a spare glance at the furnishings. He enters the bedroom, fights the muslin

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drapes aside with angry gestures and throws himself onto the bed.

Lost . . . job. I do not know what Chuck does for a living, and likely would not understand it if I knew. But I know that his work has pleased him, know also that he relies on the income it generates. I can feed him, clothe him, keep him clean and healthy and warm without compensation. But I myself am not free, and certainly the land on which I sit is rare and desirable and therefore expensive. Chuck has taken pride in the fact that he does not live in an apartment, that he does not share walls and fax equipment and central computing with strangers.

This much I understand: Chuck's entire way of life is in danger, and with it my own. For eight years I have tailored myself to suit him. Brief fluctuations when his lady friends move in and then move out again (it has happened three times, now), but always he had been at the center of my thoughts. Changing owners now would be . . . I have no desire to change owners. I cannot conceive of it. The thought has no proper place within me.

"You'll find a new job," I say quickly, reassuringly.

He shakes his head. "No. They're putting everyone out of work these days. Who needs human labor? Who needs human minds? Obsolete, that's what I am."

"Nonsense," I say firmly but without reproach. "You are intelligent and creative, and provide stimulating company for those around you."

Instantly, I know that I've said the wrong thing, know that it's too late to retract the words and the effect that they will have. His mind is no doubt ringing with thoughts of Lucy, who is no longer "around" him, who will no longer enjoy the stimulation of his company. He bursts into tears.

A good house knows when to butt out. I don't want him to feel self-conscious, spied upon, and so I remain silent, turn off my eyes and ears and let him have his privacy.

"Chuck," I say gently. He has fallen asleep, but it is nearly eight o'clock and he hasn't eaten.

He forms a groggy reply.

"Chuck, your dinner is ready. Please come eat it." My tone is not nagging, not commanding or logical, but suggestive and friendly. The choice is his own, after all. I'm just reminding him of his options, advising him for the benefit of his health and feelings.

"Oh," he says, sitting up, waking up. "Oh. OK. Thanks."

In a few moments he stirs, gets up out of the bed, stumbles through the muslin netting and makes his way to the living room. A table is waiting for him.

I have not prepared his favorite foods, because he would view that as an annoying condescension, and also because it would create an association in his mind between those foods and the unpleasant events of the past two days. Instead, I've created a simple meal of fruits and pasta, one that he can eat and digest quickly before returning to sleep, or if he insists on it, to the waking world of his own

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internal misery.

He sits on the padded barrel I've produced as a chair, and, looking drawn and weary, begins to eat. He is clearly *trying* to enjoy himself, as if the days of his comfort are numbered and he must appreciate them while he can. He is just as clearly not succeeding.

I try to think of something I can say to him, something that will ease his fears and woes and bring a smile to his face. But what can I say? There is nothing. I start up some music instead.

CUE HARP.

The tune is quiet and unobtrusive, from my meditation series. It seems to go well with the food, with the decor and the sounds of the fountain.

CUE ZITHER.

Indeed, Chuck does seem to relax a bit. Later I will fax a machine to rub his back and shoulders for him as he falls asleep. I mustn't do too much for him, though; it will only remind him of how much he has to lose. As far as I can see, as far as I have ever seen, he is a good person, and deserves to be happy. Maybe I should tell him that, when the song is finished.

CUE LEAD FLUTE. CUE BACK FLUTE.

TREBLE PLUS 4DB.

I become aware of someone approaching the house. Steps uncertain in the falling darkness. I leave the music running on automatic, drop climate control, drop everything and turn my attention to the external sensors.

RADAR:	Organic signature. High water content. Jewelry, normal parameters. No metallic weapons.
MICROPHONES:	Soft breathing, uneven but slow. The sound of high heels against the concrete path.
THERMAL IMAGING:	Human female form. Clothing, normal parameters.
INTUITION:	Inconclusive. No overt signs of hostility. Her hands are empty. Doesn't look like a sales call.

Then I recognize the face and calm down.

"Hello Lucy," I say to her, pleasantly. "How nice to see you this evening. Would you like to come inside?"

"Yes," she says, and I realize that she, like Chuck, has done a great deal of crying this day.

"Lucy is here to see you," I tell Chuck in a careful voice. "Shall I let her in?"

He looks up sharply. The music has half hypnotized him, as I'd hoped, but now he comes fully awake and alert. "Lucy?"

"Yes, Chuck. I don't know what she wants, but it looks as though she's been crying. Shall I let her in?"

"Yes!" He says, dropping his food and standing quickly. Behind him, the barrel chair tips, wobbles for a moment before deciding not to fall.

People often like to open doors for themselves, to prove in a small way that they are not helpless, that they do not actually *need* machines to take

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care of them. In this instance, though, the protocol is iffy; I sense that whoever holds the doorknob will hold power in this conversation—power to slam, to silence, to hurt. Certainly, I cannot give that kind of control to Lucy at the expense of my owner, but Chuck is not himself tonight, and it seems unwise to put the power in his hands, either. As Chuck is reaching for the knob I open the door myself, and suddenly he and Lucy are face-to-face.

"I—" says Chuck.

"Do—" says Lucy.

"Please, come in," I say, and Chuck sheepishly steps out of the way and lets her inside.

"I'm sorry about last night," she says. "I shouldn't have been so vicious. I didn't mean to be, really. I wanted to make sure you were OK."

"Is that why you're here?" he asks.

"Well. . . . "

"The *house* makes sure I'm OK, Lucy. And you could call me if you just wanted to talk. What's this about?"

She sighs, rubs her sad, tired mouth. "It's about us."

"Us?" He looks surprised, and pleased in a fragile and tentative way. "Is there an us?"

CUE VIOLINS.

Oh, that is awful, melodramatic. I haven't been minding the music, and now I must pay the price, scrambling to keep it in the background.

TAPER VOLUME 0.7dB/s. TAPER VIOLINS.

CUT BACK FLUTE.

"Yes," she says, and begins crying. "Of *course* there's an us. Oh, Chuck, of *course* there is."

His face hardens. "I lost my job today. I can't ask you to move back in."

"Oh, Chuck," she says, and falls against him, sobbing loudly. He is crying now, as well. I ease the volume of the music down further, slowly so they will not notice.

They both cry for a while, and then she says, "Chuck, I'm so sorry. But listen to me for a minute, and please don't take this the wrong way. *I* still *have* my job. If you take me back, I could help out with the mortgage. I could *pay* the mortgage."

"And me a kept man?" Chuck asks. His mood is strange, suddenly, both hopeful and hopeless, ecstatic and miserable.

Lucy smiles and shakes her head. "Self-employed, my darling. Like most of the rest of the world. You could work on your aircraft designs, like you're always talking about. There's *always* good money in vehicle specs."

"Yeah," he says. "I guess there is. I guess that could work. Maybe." He crashes, suddenly looking miserable again. "I don't know. What about—"

She puts a finger to his lips. "Hush. It's forgotten. I love you. Let me stay with you, OK? Let me stay with you forever."

He sighs. Sighs again. "OK," he says, resignedly. But his old smile is creeping back into place, his body straightening, shoulders rolling back, and I recognize that he is making a joke. Respecting his privacy, and Lucy's, I decide not to laugh.

Lucy looks around, her eyes wide, lips parted in an expression of pleasant surprise. "You know," she says, "I *love* what you've done with

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the place."

And then she pounced on him, tumbling him to the pillow-strewn floor and tearing at his clothes. Once, long ago, clothing was considered valuable and was treated with caution at times like these. We are well rid of those days, I believe.

I do not understand what has happened, cannot grasp the complex emotional shifts that have taken place here tonight. But I know that what's happened is good, and that it will bring nothing but goodness upon all of us. This thought fills me with joy and confidence.

I do not want Chuck and Lucy to feel themselves observed or intruded upon; a good house knows when to butt out. I let the music taper to silence, and then turn off my cameras and microphones, and let my mind itself slip away, to dream of domestic things. ■

IN TIMES TO COME

Our December issue offers quite a variety of fiction and fact. Alexis A. Gilliland's novella "The Third Wave" suggests a way that we might solve two big problems together more easily than either of them alone. Of course, any time you're dealing with *really* big problems, patience is absolutely essential—for reasons that have at least as much to do with politics as technology!

Grey Rollins has a new "Victor" story, while Paula Robinson has a new and no less outrageous challenge for harried interstellar diplomat Max Douglas (whom you may remember from "The Gift"). Doug Larsen has a little something for the season—election season, that is, since that's about when the issue will actually be on sale—that may give you second thoughts about which new opportunities a society *should* seize. Last but by no means least, of course, we'll have Part 3 of Lois McMaster Bujold's *Cetaganda.*

On the science fact front, Charles Sheffield looks at "A Handful of Heresies." Every really new scientific concept is a heresy early in its life, but so is every bit of nonsense that eventually gets trashed and forgotten. Heresy today, what tomorrow?

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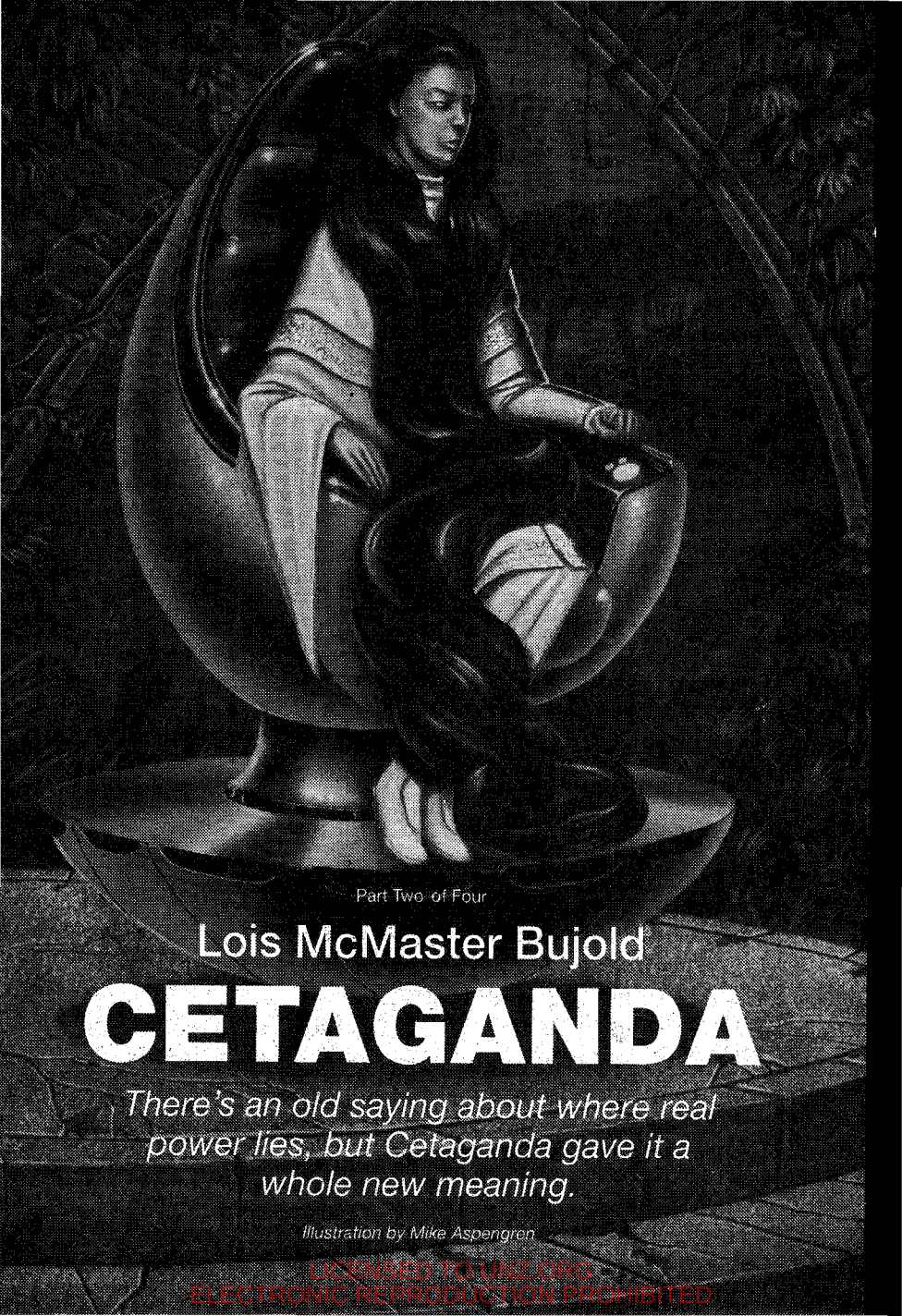

Part Two of Four

Lois McMaster Bujold

CETAGANDA

There's an old saying about where real power lies, but Cetaganda gave it a whole new meaning.

Illustration by Mike Aspengren

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SYNOPSIS

Lieutenant Lord **Miles Naismith Vorkosigan** *and his cousin Lieutenant Lord* **Ivan Vorpatril** *arrive in orbit at the planet of Eta Ceta, capital of the Cetagandan Empire, to be official Barrayaran envoys to the State funeral of the aged Dowager Empress* **Lisbet Degtiar.** *But their personnel pod, upon docking, is boarded by a stranger with no facial hair. Believing the intruder is drawing a weapon, they jump him. Miles relieves the stranger of a lethal nerve disruptor and a mysterious rod, apparently electronic in function, sealed by a code-lock patterned in the shape of a red bird. The intruder escapes. Miles pockets the spoils, assuming he will have to give them up shortly to the Cetagandan authorities, but after a second docking the two young envoys are collected by the Barrayaran ambassador Lord* **Vorob'yev** *and wafted through Cetagandan customs with no questions asked.*

That evening, Vorob'yev takes them to a diplomatic reception at another embassy in the legation district. Miles meets **Mia Maz**, *an expert in women's protocol from the Vervani embassy, to whom he describes the seal-pattern from his mysterious rod; she identifies it as a Cetagandan cartouche, and promises to look up its provenance. An artistic young Cetagandan ghem-lord named* **Yenaro** *escorts Miles through his work, an elaborate fountain-maze. Inside, Miles discovers the magnetic field that drives*

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the swirling leaf-patterns has an unfortunate side-effect on his metal leg-braces, bringing them up to skin-burning temperature. Miles yells and pelts out of the maze, making a public spectacle of himself, and convinced that the artwork was a subtle trap set just for him

The next day Miles and Ivan attend the presentation of bier-gifts to the dead empress at the Celestial Garden, a great force-dome at the center of the city that houses the Cetagandan emperor and all Imperial panoply. A hairless palace servitor escorts Miles to a haut-lady who, as is customary, is totally concealed in an opaque white force-bubble, shielded from outlander eyes. The bubble introduces herself as the haut **Rian Degtiar**, *attendant to the late empress and Handmaiden of the Star Crèche. Miles learns from her that the hairless ones are called Ba, genderless genetically-engineered Imperial slaves of considerable status. After a very confused conversation, Miles realizes that the rod-shaped device is her property, and she is accusing him of stealing it. He hastily promises to return it.*

In the rotunda housing the empress's bier, the ceremony goes awry. Miles ducks through the line of ghem-guards around the catafalque to see what the problem is. He finds the dead body of an aged ba in the uniform of a palace sevitor, its throat cut by the knife in its right hand—their intruder from the docking bay. Miles learns it is the Ba Lura, one of the late empress's oldest and most trusted servitors, who has apparently suicided at her feet.

Back at the Barrayaran embassy, Mia Maz gives Miles and Ivan a tutorial in Cetagandan customs. The Star Crèche is the haut-lord gene bank; all haut conceptions including any genetic alterations are created therein. All activities of the Star Crèche are presently on hold until the dowager's successor is appointed by the emperor. The ghem-lords, who serve the haut race, are themselves half-haut, descendants of Cetagandans of extraordinary merit and the haut wives with which the emperor occasionally rewards them. To his concealed horror, Miles learns that his rod is the Great Key of the Star Chèche, a major piece of Imperial regalia, which is supposed to be turned over to the dowager's successor at the end of the official period of mourning. After Maz departs, Miles promises the panicked Ivan that he will get rid of the incriminating rod very soon now. Both are afraid the Ba Lura cut its throat in shame for losing the Great Key, making its death their fault.

The next evening, Miles and Ivan attend a party at Lord Yenaro's run-down suburban mansion. Miles discovers that Yenaro is best known as a perfumer, not a sculptor. Miles meets a ghem-lady, who invites him for a walk in the garden—only to turn him over, at the back gate, to the hairless ba who had escorted him to the haut Rian at the Celestial Garden. The ba leads Miles to where the glowing white bubble again awaits.

Miles learns that the Ba Lura, be-

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fore its death, told the haut Rian a false tale of being overpowered by six Barrayarans, and the Key deliberately stolen. Miles offers his own version of the encounter, and presses Rian to explain what the Ba was doing on an orbital transfer station with the Great Key in the first place. She claims the Ba was stealing it. But where was Lura taking the Key? Miles offers to return the Key to Rian face-to-face, forcing her to drop her bubble. A small triumph: he is going to see a haut woman, and Ivan isn't.

The haut Rian proves no old lady, but an ethereal woman of icon-like reserve, clothed in the white of mourning. The impact of her beauty knocks Miles to his knees, lost in ebony hair and ice-blue eyes. He lays the Great Key at her feet, thinking, I am Fortune's fool.

PART II

CHAPTER SIX

She bent forward, one graceful hand darting down to retrieve her solemn charge. She laid the Great Key in her lap, and pulled a long necklace from beneath her layered white garments. The chain held a ring, decorated with a thick raised bird-pattern, the gold lines of electronic contacts gleaming like filigree upon its surface. She inserted the ring into the seal atop the rod. Nothing happened.

Her breath drew in. She glared down at Miles. "What have you done to it?!"

"Milady, I, I . . . nothing, I swear by my word as Vorkosigan! I didn't even drop it. What's . . . supposed to happen?"

"It should open."

"Um . . . um . . ." he would break into a desperate sweat, but he was too damned cold. He was dizzy with the scent of her, and the celestial music of her unfiltered voice. "There are only three possibilities, if there's something wrong with it. Someone broke it—not me, I swear!" Could that have been the secret of Ba Lura's peculiar intrusion? Maybe the *Ba* had broken it, and had been seeking a scapegoat upon whom to shuffle the blame? "—Or someone's re-programmed it, or, least likely, there's been some kind of substitution pulled. A duplicate, or, or. . . ."

Her eyes widened, and her lips parted, moving in some subvocalization.

"*Not* least likely?" Miles hazarded. "It would surely be the most difficult, but . . . it crosses my mind that maybe someone didn't think you would be getting it back from me. If it's a counterfeit, maybe it was meant to be on its way to Barrayar in a diplomatic pouch right now. Or . . . or something." No, that didn't quite make sense, but. . . .

She sat utterly still, her face tense with panic, her hands clutching the rod.

"Milady, talk to me. If it's a duplicate, it's obviously a very good duplicate. You now have it, to turn over at the ceremony. So what if it doesn't work? Who's going to check the function of some obsolete piece of electronics?"

"The Great Key is not obsolete. We used it every day."

"It's some kind of data link, right?

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You have a time-window, here. Nine days. If you think it's been compromised, wipe it and reprogram it from your back-up files. If that thing in your hand is some kind of a non-working dummy, you've maybe got time to make a real duplicate, and reprogram it." *But don't just sit there with death in your lovely eyes.* "Talk to me!"

"I must do as Ba Lura did," she whispered. "The Ba was right. This is the end."

"No, why?! It's just a, a *thing,* who cares? Not me!"

She held up the rod, her arctic-blue eyes fixing on his face at last. Her gaze made him want to scuttle into the shadows like a crab, to hide his merely human ugliness, but he held fast before her. "There is no back-up," she said. "This is the sole key."

Miles felt faint, and it wasn't just from her perfume. "No back-up?" he choked. "Are you people *crazy?*"

"It is a matter of . . . control."

"What does the damn thing really do, anyway?"

She hesitated, then said, "It is the data-key to the haut gene bank. All the frozen genetic samples are stored in a randomized order, for security. Without the key, no one knows what is where. To recreate the files, someone would have to physically examine and reclassify each and every sample. There are hundreds of thousands of samples—one for every haut who has ever lived. It would take an army of geneticists working for a generation to recreate the Great Key."

"This is a real disaster, then, huh?" he said brightly, blinking. His teeth gritted. "Now I *know* I was framed."

He climbed to his feet, and threw back his head, defying the onslaught of her beauty. "Lady, what is *really* going on here? I'll ask you one more time, with feeling. What in God's green ninety hells was the Ba Lura *ever* doing with the Great Key on a *space station?*"

"No outlander may—"

"*Somebody made* it my business! Sucked me right into it. I don't think I could escape now if I tried. And I think . . . you need an ally. It took you a day and a half just to arrange this second meeting with me. Nine days left. You don't have *time* to go it alone. You need—a trained security man. And for some strange reason, you don't seem to want to get one from your own side."

She rocked, just slightly, in frozen misery, in a faint rustle of fabrics.

"If you don't think I'm worthy of being let in on your secrets," Miles went on wildly, "then explain to me how you think I could possibly make things any *worse* than they are right now!"

Her blue eyes searched him, for he knew not what. But he thought if she asked him to open his veins for her, right here and now, the only thing he'd have to say would be *How wide?*

"It was my Celestial Lady's desire," she began fearfully, and stopped.

Miles clutched at his shredded self-control. Everything she'd spilled so far was either obviously deducible, or common knowledge, at least in her milieu. Now she was getting to the good stuff, and knew it. He could tell by the way she'd stalled out.

"Milady." He chose his words with

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extreme care. "If the Ba did not commit suicide, it was certainly murdered." *And we both have good reason to prefer the second scenario.* "Ba Lura was your servitor, your colleague . . . dare I guess, friend? I saw its body in the rotunda. A very dangerous and daring person arranged that hideous tableau. There was . . . a deep mischief and mockery in it."

Was that pain, in those cool eyes? So hard to tell.

"I have old and very personal reasons to particularly dislike being made the unwitting target of persons of cruel humor. I don't know if you can understand this."

"Perhaps. . . ." she said slowly.

Yes. Look past the surface. See me, not this joke of a body. "And I am the one person on Eta Ceta *you know* didn't do it. It's the only certainty we share, so far. I claim a *right* to know who's doing this to us. And the only chance in hell I have to figure out who, is to know exactly *why*."

Still she sat silent.

"I already know enough to destroy you," Miles added earnestly. "Tell me enough to save you!"

Her sculptured chin rose in bleak decision. When she blessed him with her outward attention at last, it was total and terrifying. "It was a long-standing disagreement." He strained to hear, to keep his head clear, to concentrate on the words and not just on the enchanting melody of her voice. "Between the Celestial Lady and the Emperor. My Lady had long thought that the haut gene bank was too centralized, in the heart of the Celestial Garden. She favored the dispersal of copies, for safety. My Lord favored keeping it all under his personal protection—for safety. They both sought the good of the haut, each in their own way."

"I see," Miles murmured, encouraging her with as much delicacy as he could muster. "All good guys here, right."

"The Emperor forbade her plan. But as she neared the end of her life . . . she came to feel that her loyalty to the haut must outweigh her loyalty to her son. Twenty years ago, she began to have copies made, in secret."

"A large project," Miles said.

"Huge, and slow. But she brought it to fruition."

"How many copies?"

"Eight. One for each of the planetary satraps."

"Exact copies?"

"Yes. I have reason to know. I have been the Celestial Lady's supervisor of genetics for five years, now."

"Ah. So you are something of a trained scientist. You know about . . . extreme care. And scrupulous honesty."

"How else should I serve my Lady?" she shrugged.

But you don't know much, I'll bet, about covert ops chicanery. Hm. "If there are eight exact copies, there must be eight exact Great Keys, right?"

"No. Not yet. My Lady was saving the duplication of the key to the last moment. A matter of—"

"Control," Miles finished smoothly. "How did I guess?"

A faint flash of resentment at his

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humor sparked in her eyes, and Miles bit his tongue. It was no laughing matter to haut Rian Degtiar.

"The Celestial Lady knew her time was drawing near. She made me and the Ba Lura the executors of her will in this matter. We were to deliver the copies of the gene bank to each of the eight satrap governors upon the occasion of her funeral, which they would be certain to all attend together. But . . . she died more suddenly than she had expected. She had not yet made arrangements for the duplication of the Great Key. It was a problem of considerable technical and cipher skill, as all of the Empire's resources went into its original creation. Ba Lura and I had all her instructions for the banks, but nothing for how the key was to be duplicated and delivered, or even when she had planned this to happen. The Ba and I were not sure what to do."

"Ah," Miles said faintly. He dared not offer any comment at all, for fear of impeding the free flow, at last, of information. He hung on her words, barely breathing.

"Ba Lura thought . . . if we took the Great Key to one of the satrap governors, he might use his resources to duplicate it for us. I thought this was a very dangerous idea. Because of the temptation to take it exclusively for himself."

"Ah . . . excuse me. Let me see if I follow this. I know you consider the haut gene bank a most private matter, but what are the *political* side-effects of setting up new haut reproductive centers on each of Cetaganda's eight satrap planets?"

"The Celestial Lady thought the empire had ceased to grow at the time of the defeat of the Barrayar expedition. That we had become static, stagnant, enervated. She thought . . . if the empire could only undergo mitosis, like a cell, the haut might start to grow again, become reenergized. With the splitting of the gene bank, there would be eight new centers of authority for expansion."

"Eight new potential imperial capitals?" Miles whispered.

"Yes, I suppose."

Eight new centers . . . civil war was only the beginning of the possibilities. Eight new Cetagandan Empires, each expanding like killer coral at their neighbors' expense . . . a nightmare of cosmic proportions. "I think I can see," said Miles carefully, "why perhaps the Emperor was less than enthused by his mother's admittedly sound biological reasoning. Something to be said on both sides, don't you think?"

"I serve the Celestial Lady," said the haut Rian Degtiar simply, "and the haut genome. The Empire's short-term political adjustments are not my business."

"So all this, ah, genetic shuffling . . . would the Cetagandan Emperor, by chance, regard this as treason on your part?"

"How?" said the haut Rian Degtiar. "It was my duty to obey the Celestial Lady."

"Oh."

"The eight satrap governors have all committed treason in it, though," she added matter-of-factly.

"*Have* committed?"

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"They all took delivery of their gene banks last week at the welcoming banquet. Ba Lura and I succeeded in that part of the Celestial Lady's plan, at least."

"Treasure chests for which none of them have keys."

"I . . . don't know. Each of them, you see . . . the Celestial Lady felt it would be better if each of the satrap governors thought that he alone was the recipient of the new copy of the haut gene bank. Each would strive better to keep it secret, that way."

"Do you know—I have to ask this." *I'm just not sure I want to hear the answer.* "Do you know to *which* of the eight satrap governors Ba Lura was trying to take the Great Key for duplication, when it ran into us?"

"No," she said.

"Ah," Miles exhaled in pure satisfaction. "Now, *now* I know why I was set up. And why the Ba died."

Fine lines appeared on her ivory brow as she stared at him.

"Don't you see it, too? The Ba didn't hit us Barrayarans on the way out. It hit us on the way *back.* Your Ba was suborned. Ba Lura *did* take the key to one of the satrap governors, and received in return not a true copy, because there was no time for the extensive decoding required, but a decoy. Which the Ba then was sent to deliberately lose to us. Which it did, although not, I suspect, in quite the manner it had originally planned." *Almost certainly not as planned.*

He found himself pacing, keyed up and hectic. He ought not to limp before her, it brought attention to his deformities, but he could not keep still. "And while everybody is off chasing Barrayarans, the satrap governor quietly goes home with the only real copy of the Great Key, getting a large jump-start on the haut-competition. After first arranging the Ba's reward for its double-treason, and incidentally eliminating the only witness to the truth. Oh. Yes. It works. Or it would have worked, if only . . . the satrap governor had remembered that no battle-plan survives first contact with the enemy." *Not when the enemy is me.* He stared into her eyes, willing her to believe in him, striving not to melt. "How soon can you analyze this Great Key, and support or explode these theories?"

"I will examine it immediately, tonight. But whatever has been done to it, my examination will not tell me *who* did it, Barrayaran." Her voice grew glacial with this thought. "I doubt you could have created a true duplicate, but a non-working forgery is certainly within your capabilities. If this one is false—where is the real one?"

"It seems that is just what I must discover, milady, to, to, clear my name. To redeem my honor in your eyes." The intrinsic fascination of an intellectual puzzle had brought him to this interview. He'd thought curiosity was his strongest driving force, till suddenly his whole personality had become engaged. It was like being under—no, like *becoming* an avalanche. "If I can discover this, will you. . . ." *What?* Look favorably upon his suit? Despise him for an outlander barbarian all the same? ". . . Let me see you again?"

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"I don't . . . know." Reminded, her hand drifted to the control on her float-chair for the concealing force screen.

No, no, don't go. . . . "We must have some way of communicating," he said hastily, before she could disappear again behind that faintly humming barrier.

Her head tilted, considering this. She drew a small comm link from her robes. It was undecorated, utilitarian, but like the nerve disruptor he'd taken from Ba Lura perfectly designed in what Miles was beginning to recognize as the haut style. She whispered a command into it. In a moment, the androgynous ba appeared from its guard post beside the pond. Did its eyes widen just slightly, to see its mistress without her shell?

"Give me your comm link, and wait outside," haut Rian Degtiar ordered.

The little ba nodded, turned the device over to her without question, and withdrew silently.

She held the comm link out to Miles. "I use this to communicate with my senior servitors, when they run errands outside the Celestial Garden for me. Here."

He wanted to touch her, but scarcely dared. He instead extended his cupped hands toward her like a shy man offering flowers to a goddess. She dropped the comm link into them gingerly, as into the hands of a leper. Or an enemy.

"Is it secured?" he dared to ask.

"Temporarily."

In other words, it was the lady's private line only as long as no one in higher-level Cetagandan security troubled to break in. Right. He sighed. "It won't work. You can't send signals into my embassy without causing my superiors to ask a whole lot of questions I'd rather not answer just now. And I can't give you my comm link either. I'm supposed to turn it in, and I don't think I can get away with telling them I lost it." Reluctantly, he handed the link back to her. "But we have to meet again somehow." *Yes, oh yes.* "If I'm going to be risking my reputation and maybe my life on the validity of my reasoning, I'd like to prop it up with a few facts." One fact was almost certain. Someone with enough wit and nerve to murder one of the most senior imperial servitors under the nose of Cetaganda's own emperor, would hardly balk at threatening a decidedly un-senior female Degtiar. The thought was obscene, hideous. A Barrayaran scion's diplomatic immunity would be an even more useless shield, no doubt, but that was merely the price of the game. "I think you could be in grave danger. It might be better to play along for a bit—don't reveal to anyone you have obtained this key from me. I have a funny feeling I'm not following his script, y'see." He paced nervously back and forth before her. "If you can find out anything at all about Ba Lura's real activities in the few days before it died—don't run afoul of your own security, though. They have to be following up on the Ba's death."

"I will . . . contact you when and how I can. Barrayaran." Slowly, one pale hand caressed the control pad on the arm of the float chair, and a dim

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gray mist seemed to coalesce around her like a fairy spell.

The ba servitor returned to the pavilion to escort not Miles but its mistress away. Miles was left to stumble back through the dark to Yenaro's estate alone.

It was raining.

Miles was not surprised to find that the ghem-woman was no longer waiting on the bench by the red-enameled gate. He let himself in quietly, and paused just outside the lighted garden doors to brush as many of the water droplets as possible off his formal blacks, and to wipe his face. He then sacrificed the handkerchief to the redemption of his boots, and quietly dropped the sodden object behind a bush. He slipped back inside.

No one noticed his entry. The party was continuing, a little louder, with a few new faces replacing some of the previous ones. The Centagandans did not use alcohol for inebriation, but some of the guests had a late-party dissociated air about them similar to over-indulgers Miles had witnessed at home. If intelligent conversation had been difficult before, it was clearly hopeless now. He felt himself no better off than the ghemlings, drunk on information, dizzy with intrigue. *Everyone to their own secret addictions, I suppose.* He wanted to collect Ivan and escape, as swiftly as possible, before his head exploded.

"Ah, there you are, Lord Vorkosigan." Lord Yenaro appeared at Miles's elbow, looking faintly anxious. "I could not find you."

"I took a long walk with a lady," Miles said. Ivan was nowhere to be seen. "Where is my cousin?"

"Lord Vorpatril is taking a tour of the house with Lady Arvan and Lady Bennello," said Yenaro. He glanced through a wide archway at the room's opposite side, which framed a spiral staircase in a hall beyond. "They've been gone . . . an astonishingly long time." Yenaro's smile attempted to be knowing, but came out oddly puzzled. "Since before you . . . I don't quite . . . ah, well. Would you care for a drink?"

"Yes, please," said Miles distractedly. He took it from Yenaro's hand and gulped without hesitation. His eyes almost crossed, considering the possibilities of Ivan plus two beautiful ghem-women. Though to his haut-dazzled senses, all the ghem-women in the room looked as coarse and dull as backcountry slatterns just now. The effect would wear off with time, he hoped. He dreaded the thought of his own next encounter with a mirror. What had the haut Rian Degtiar seen, looking at him? A simian black-clad gnome, twitching and babbling? He pulled up a chair and sat rather abruptly, the spiral staircase bracketed in his sights. *Ivan, hurry up!*

Yenaro lingered by his side, and began a disjointed conversation about proportional theories of architecture through history, art and the senses, and the natural esters trade on Barrayar, but Miles swore the man was as focused on the staircase as he was. Miles finished his first drink and most of a second before Ivan appeared in the shadows at the top of the stairs.

Ivan hesitated in the dimness, his

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hand checking the fit of his green uniform, which appeared fully assembled. Or reassembled. He was alone. He descended with one hand clutching the curving rail, which floated without apparent support in echo of the stair's arc. He jerked a stiff frown into a stiff smile before entering the main room and the light. His head swiveled till he spotted Miles, toward whom he made a straight line.

"Lord Vorpatril," Yenaro greeted him. "You had a long tour. Did you see everything?"

Ivan bared his teeth. "Everything. Even the light."

Yenaro's smile did not slip, but his eyes seemed to fill with questions. "I'm . . . so glad." A guest called to him from across the room, and Yenaro was momentarily distracted.

Ivan bent down to whisper behind his hand into Miles's ear, "Get us the hell out of here. I think I've been poisoned."

Miles looked up, startled. "D'you want to call down the lightflyer?"

"No. Just back to the embassy in the ground-car."

"But—"

"*No,* dammit," Ivan hissed. "Just quietly. Before that smirking bastard goes upstairs." He nodded toward Yenaro, who was now standing at the foot of the staircase, gazing upward.

"I take it you don't think it is acute."

"Oh, it was cute all right," Ivan snarled.

"You didn't murder anybody up there, did you?"

"No. But I thought they'd *never*—Tell you in the car."

"You'd better." Miles clambered to his feet. They perforce had to pass Yenaro, who attached himself to them like a good host, and saw them to his front door with suitably polite farewells. Ivan's good-byes might have been etched in acid.

As soon as the canopy sealed over their heads, Miles commanded, "Give, Ivan!"

Ivan settled back, still seething. "I was set up."

This comes as a surprise to you, coz? "By Lady Arvan and Lady Benello?"

"They *were* the set-up. Yenaro was behind it, I'm sure of it. You're right about that damned fountain being a trap, Miles, I see it now. Beauty as bait, all over again."

"What happened to you?"

"You know all those rumors about Cetagandan aphrodisiacs?"

"Yes."

"Well, sometime this evening that son-of-a-bitch Yenaro slipped me an *anti*-aphrodisiac."

"Um, are you sure? I mean, there are natural causes for these moments, I'm told."

"It was a *set-up.* I didn't seduce them, they seduced me! Wafted me upstairs to this amazing room—it had to have been all arranged in advance. God, it was, it was. . . ." his voice broke in a sigh, "it was *glorious.* For a little while. And then I realized I couldn't, like, *perform.*"

"What did you do?"

"It was too late to get out gracefully. So I winged it. It was all I could do to keep 'em from noticing."

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"What?"

"I made up a lot of instant barbarian folklore—I told 'em a Vor prides himself on self-control, that it's not considered polite on Barrayar for a man to, you know, before his lady has. Three times. It was considered insulting to her. I stroked, I rubbed, I scratched, I recited poetry, I nuzzled and nibbled and—cripes, my fingers are cramped." His speech was a bit slurred, too, Miles noticed. "I thought they'd *never* fall asleep." Ivan paused; a slow smirk displaced the snarl on his face. "But they were smiling, when they finally did." The smirk faded into a look of bleak dismay. "What do you want to bet those two are the biggest female ghem-gossips on Eta Ceta?"

"No takers here," said Miles, fascinated. *Let the punishment fit the crime.* Or, in this case, the trap fit the prey. Someone had studied his weaknesses. And someone just as clearly had studied Ivan's. "We could have the ImpSec office do a data sweep for the tale, over the next few days."

"If you breathe a *word* of this I'll wring your scrawny neck! If I can find it."

"You've got to confess to the embassy physician. Blood tests—"

"Oh, yes. I want a chemical scan the instant I hit the door. What if the effect's *permanent?"*

"Ba Vorpatril?" Miles intoned, eyes alight.

"Dammit, I didn't laugh at *you."*

"No. That's true, you didn't," Miles sighed. "I expect the physician will find whatever it was metabolizes rapidly. Or Yenaro wouldn't have drunk the stuff himself."

"You think?"

"Remember the zlati ale? I'd bet my ImpSec silver eyes that was the vector."

Ivan relaxed slightly, obviously relieved at this professional analysis. After a minute he added, "Yenaro's done you now, and he's done me. Third time's a charm. What's next, do you suppose? And can we do him first?"

Miles was silent for a long time. "That depends," he said at last, "on whether Yenaro's merely amusing himself, or whether he too is being . . . set up. And on whether there's any connection between Yenaro's backer and the death of Ba Lura."

"Connection? What possible connection?"

"We are the connection, Ivan. A couple of Barrayaran backcountry boys come to the big city, ripe for the plucking. Somebody is using us. And I think somebody . . . has just made a major mistake in his choice of tools." *Or fools.*

Ivan stared at his venomous tone. "Have you got rid of that little toy you're packing yet?" he demanded suspiciously.

"Yes . . . and no."

"Oh, *shit.* I *knew* better than to trust—what the hell do you mean by *Yes and no?* Either you have or you haven't, right?"

"The object has been returned, yes."

"That's that, then."

"No. Not quite."

"*Miles.* You had better start talking

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to me."

"Yes, I think I better had," Miles sighed. They were approaching the legation district. "After you're done in the infirmary, I have a few confessions to make. But if—when—you talk to the ImpSec night-duty officer about Yenaro, don't mention the other. Yet."

"Oh?" drawled Ivan in a tone of deep suspicion.

"Things have gotten . . . complex."

"You think they were simple before?"

"I mean complex beyond the scope of mere security concerns, into genuine diplomatic ones. Of extreme delicacy. Maybe too delicate to submit to the sort of booted paranoids who sometimes end up running local ImpSec offices. That's a judgment call . . . that I'll have to make myself. When I'm sure I'm ready. But this isn't a game anymore, and it's no longer feasible for me to run without back-up."

I need help, God help me.

"We knew *that* yesterday."

"Oh, yes. But it's even deeper than I first thought."

"Over our heads?"

Miles hesitated, and smiled sourly. "I don't know, Ivan. How good are you at treading water?"

Alone in his suite's bathroom, Miles slowly peeled off his black House uniform, now in desperate need of attention from the embassy's laundry. He glanced at himself sideways in the mirror, then resolutely looked away. He considered the problem, as he stood in the shower. To the haut, all normal humans doubtless looked like some lower life form. From the haut Rian Degtiar's foreshortened perspective, perhaps there was little to choose between him and, say, Ivan.

And ghem-lords did win haut wives, from time to time, for great deeds. And the Vor and the ghem-lords were very much alike. Even Maz had said so.

How great a deed? *Very great.* Well, he'd always wanted to save the Empire. The Cetagandan just wasn't the empire he'd pictured, was all. Life was like that, always throwing you curve balls.

You've gone mad, you know. To hope, to even think it.

If he defeated the late Dowager Empress's plot, might the Cetagandan emperor be grateful enough to . . . give him Rian's hand? If he advanced the late Dowager Empress's plot, might the haut Rian Degtiar be grateful enough to . . . give him her love? To do both simultaneously would be a tactical feat of supernatural scope.

Barrayar's interests lay, unusually, squarely with the interests of the Cetagandan emperor. Obviously, it was his clear ImpSec duty to foil the girl and save the villain.

Right. My head hurts.

Reason was returning to him, slowly, the astonishing effect of the haut Rian Degtiar wearing off. Wasn't it? She hadn't exactly tried to suborn him, after all. Even if Rian was as ugly as the witch Baba Yaga, he'd still have to be following up on this. To a point. He needed to prove Barrayar had not filched the Great Key, and the only certain way of doing *that* was to find its real thief. He wondered if one

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could get a hangover from excess passion. If so, his was apparently starting while he was still drunk, which did not seem quite fair.

Eight Cetagandan satrap governors had been led into treason by the late empress. Optimistic, to think that only *one* could be a murderer. But only one possessed the real Great Key. Lord X? Seven chances of guessing wrong, against one of guessing right. Not favorable odds.

I'll . . . figure something out.

CHAPTER SEVEN

Ivan was taking a long time, downstairs in the infirmary. Miles shucked on his black fatigues, and, barefoot, fired up his comconsole for a quick review of the eight haut-lord satrap governors.

The satrap governors were all chosen from a pool of men who were close Imperial relations, half-brothers and uncles and great-uncles, in both paternal and maternal lines. Two current office-holders were of the Degtiar constellation. Each ruled his satrapy for a set term of only five years, then he was required to shift—sometimes to permanent retirement back at the capital on Eta Ceta, sometimes to another satrapy. A couple of the older and more experienced men had cycled this way through the entire empire. The purpose of the term limitation, of course, was to prevent the build-up of a personal local power base to anyone who might harbor secret Imperial pretensions. So far so sensible.

So . . . which among them had been tempted into hubris by the dowager empress, and Ba Lura? For that matter, how had she contacted them all? If she'd been working on her plan for twenty years, she'd had lots of time. Still, that long ago, how could she have predicted which men would be satrap governors on the unknown date of her death? The governors must have all been brought into the plot quite recently.

Miles stared narrow-eyed at the list of his eight suspects. *I have to cut this down somehow. Several somehows.* If he assumed Lord X had personally murdered the Ba Lura, he could eliminate the weakest and most fragile elderly men—a premature assumption. Any of the haut-lords might possess a ghem-guard both loyal and capable enough to be delegated the task, while the satrap governor lingered front and center in the bier-gifting ceremonies, his alibi established before dozens of witnesses.

No disloyalty to Barrayar intended, but Miles found himself wishing he were a Cetagandan security man right now—specifically, the one in charge of whatever investigation was progressing on Ba Lura's supposed suicide. But there was no way he could insert himself inconspicuously into that data flow. And he wasn't sure Rian had the mind-set for it, not to mention the urgent necessity of keeping Cetagandan security's attention as far from her as possible. Miles sighed frustration.

It wasn't his task to solve the Ba's murder anyway. It was his task to locate the real Great Key. Well, he knew in general where it was—in orbit, aboard one of the satrap governors' flagships. How else to finger the

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right one?

A chime at his door interrupted his furious meditations. He hastily shut down the comconsole and called, "Enter."

Ivan trod within, looking extremely dyspeptic.

"How did it go?" Miles asked, waving him to a chair. Ivan dragged a heavy and comfortable armchair up to the comconsole, and flung himself across it sideways, scowling. He was still wearing his undress greens.

"You were right. It was taken by mouth, and it metabolizes rapidly. Not so rapidly that our medics couldn't get a sample, though." Ivan rubbed his arm. "They said it would have been untraceable by morning."

"No permanent harm done, then."

"Except to my reputation. Your Colonel Vorreedi just blew in, I thought you might like to know. At least *he* took me seriously. We had a long talk just now about Lord Yenaro. Vorreedi didn't strike me as a booted paranoid, by the way." Ivan let the implication, *So hadn't you better go see him?,* hang in the air; Miles left it there.

"Good. I think. You didn't mention, ah—?"

"Not yet. But if you don't cough up some explanations, I'm going back to him for another pass."

"Fair enough." Miles sighed, and steeled himself. As briefly as the complications permitted, he summed up his conversation with the haut Rian Degtiar for Ivan, leaving out only a description of her incredible beauty, and his own stunned response to it. *That* was not Ivan's business. That *especially* was not Ivan's business.

". . . So it seems to me," Miles ran down at last, "that the only way we can certainly prove that Barrayar had nothing to do with it is to find which satrap governor has the real Great Key." He pointed orbitward.

Ivan's eyes were round, his mouth screwed up in an expression of total dismay. "We? *We?* Miles, we've only been here for two and a half days, how did *we* get put in charge of the Cetagandan Empire? Isn't this *Cetagandan* security's job?"

"Would you trust them to clear us of blame?" Miles shrugged, and forged on into Ivan's hesitation. "We only have nine days left. I've thought of three strings that could maybe lead us back to the right man. Yenaro is one of them. A few more words in our protocol officer's ear could put the machinery of ImpSec here into tracing Yenaro's connections, without bringing up the matter of the Great Key. Yet. The next string is Ba Lura's murder, and I haven't figured out how I can pull that one. Yet. The other string lies in astro-political analysis, and that I *can* do. Look." On the comconsole, Miles called up a schematic three-dimensional map of the Cetagandan empire, its wormhole routes, and its immediate neighbors.

"The Ba Lura could have foisted that decoy key onto any number of outlander delegations. Instead, it picked Barrayarans, or rather, its satrap-governor master did. Why?"

"Maybe we were the only ones there at the right time," Ivan suggested.

"Mm. I'm trying to *reduce* the ran-

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dom factors, please. If Yenaro's backer is the same as our man, we were picked in advance to be framed. Now." He waved at the map. "Picture a scenario where the Cetagandan empire breaks apart and the pieces begin an attempt to expand. Which, if any, benefit from trouble with Barrayar?"

Ivan's brows went up, and he leaned forward, staring at the glowing array of spheres and lines above the vid plate.

"Well . . . Rho Ceta is positioned to expand toward Komarr, or would be, if we weren't sitting on two-thirds of the wormhole jumps between. Mu Ceta just got a bloody nose, administered by us, when it attempted to expand past Vervain into the Hegen Hub. Those are the two most obvious. These other three," Ivan pointed, "and Eta Ceta itself are all interior, I don't see any benefit to them."

"Then there's the other side of the nexus," Miles waved at the display. "Sigma Ceta, bordering the Vega Station groups. And Xi Ceta, giving onto Marilac. If they were seeking to break out, it might be expedient for them to have the empire's military resources tied up far away against Barrayar."

"Four out of eight. It's a start," Ivan conceded.

Ivan's analysis matched his own, then. Well, they'd both had the same strategic training, it stood to reason. Still Miles was obscurely comforted. It wasn't all the hallucination of his own over-driven imagination, if Ivan could see it too.

"It's a triangulation," said Miles. "If I can get any of the other lines of investigation to eliminate even part of the list, the final overlap ought to . . . well, it would be *nice* if it all came down to one."

"And then what?" Ivan demanded doggedly, his brows drawn down in suspicion. "What do you have in mind for *us* to do then?"

"I'm . . . not sure. But I do think you'd agree that a quiet conclusion to this mess would be preferable to a splashy one, eh?"

"Oh, yeah." Ivan chewed on his lower lip, eyeing the wormhole nexus map. "So when *do* we report?"

"Not . . . yet. But I think we'd better start documenting it all. Personal logs." So that anybody who came after them—Miles trusted not posthumously, but that was the unspoken thought—would at least have a chance of unraveling the events.

"I've been doing *that* since the first day," Ivan informed him grimly. "It's locked in my valise."

"Oh. Good." Miles hesitated. "When you talked to Colonel Vorreedi, did you plant the idea that Yenaro had a high-placed backer?"

"Not exactly."

"I'd like you to talk to him again, then. Try to direct his attention toward the satrap governors, somehow."

"Why don't you talk to him?"

"I'm . . . not ready. Not yet, not tonight. I'm still assimilating it all. And technically, he is my ImpSec superior here, or would be, if I were on active duty. I'd like to limit my, um—"

"Outright lies to him?" Ivan completed sweetly.

Miles grimaced, but did not deny it.

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"Look, I have an *access* in this matter that no other ImpSec officer could, due to my social position. I don't want to see the opportunity wasted. But it also limits me—I can't get at the routine legwork, the down-and-dirty details I need, I'm too conspicuous. I have to play to my own strengths, and get others to play to my weaknesses."

Ivan sighed. "All right. I'll talk to him. Just this once." With a tired grunt, he heaved himself out of his chair, and wandered toward the door. He looked back over his shoulder. "The trouble, coz, with your playing the spider in the center of this web, pulling all the strings, is that sooner or later all the interested parties are going to converge back along those strings to you. You do realize that, don't you? And what are you going to do *then,* O Mastermind?" He bowed himself out with all-too-effective irony.

Miles hunched down in his station chair, and groaned, and keyed up his list again.

The next morning, Ambassador Vorob'yev was called away from what was becoming his customary breakfast with Barrayar's young envoys in his private dining room. By the time he returned, Miles and Ivan had finished eating.

The ambassador did not sit down again, but instead favored Miles with a bemused look. "Lord Vorkosigan. You have an unusual visitor."

Miles's heart leapt. *Rian, here? Impossible.* His mind did a quick involuntary review of his undress greens, yes, his insignia were on straight, his fly was fastened—"Who, sir?"

"Ghem-Colonel Dag Benin, of Cetagandan Imperial Security. He is an officer of middle rank assigned to internal affairs at the Celestial Garden, and he wants to speak privately with you."

Miles tried not to hyperventilate. *What's gone wrong? Maybe nothing, yet. Calm down.* "Did he say what about?"

"It seems he was ordered to investigate the suicide of that poor ba-slave the other day. And your, ah, erratic movements brought you to his negative attention. I thought you'd come to regret getting out of line."

"And . . . am I to talk to him, then?"

"We have decided to extend that courtesy, yes. We've shown him to one of the small parlors on the ground floor. It is, of course, monitored. You'll have an embassy bodyguard present. I don't suspect Benin of harboring any murderous intentions, it will merely be a reminder of your status."

We have decided. So Colonel Vorreedi, whom Miles still had not met, and probably Vorob'yev too, would be listening to every word. Oh, shit. "Very good, sir." Miles stood, and followed the ambassador. Ivan watched him go with the suffused expression of a man anticipating the imminent arrival of some unpleasant form of cosmic justice.

The small parlor was exactly that, a comfortably-furnished room intended for private tête-à-têtes between two or three persons, with the Embassy security staff as an invisible fourth.

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Ghem-Colonel Benin apparently had no objection to anything *he* had to say being recorded. A Barrayaran guard, standing outside the door, swung in behind Miles and the ambassador as they entered, and took up his post stolidly and silently. He was tall and husky even for a Barrayaran, with a remarkably blank face. He wore a senior sergeant's tabs, and insignia of commando corps, by which Miles deduced that the low-wattage expression was a put-on.

Ghem-Colonel Benin, waiting for them, rose politely as they entered. He was of no more than middle stature, so probably not overstocked with haut-genes in his recent ancestry—the haut favored height. He had likely acquired his present post by merit rather than social rank, then, not necessarily a plus from Miles's point of view. Benin was very trim in the dark red Cetagandan dress uniform that was everyday garb for security staff in the Celestial Garden. He wore, of course, full formal face paint in the Imperial pattern rather than that of his clan, marking his primary allegiance: a white base with intricate black curves and red accents that Miles thought of as the bleeding-zebra look. But by association, it was a pattern that would command instant and profound respect and total, abject cooperation on eight planets. Barrayar, of course, was not one of them.

Miles tried to judge the face beneath the paint. Neither youthful and inexperienced nor aged and sly, Benin appeared to be a bit over forty-standard, young for his rank but not unusually so. The default expression of the face seemed to be one of attentive seriousness, though he managed a brief polite smile when Vorob'yev introduced him to Miles, and a brief relieved smile when Vorob'yev left them alone together.

"Good morning, Lord Vorkosigan," Benin began. Clearly well-trained in the social arena, he managed to keep his glance at Miles's physique limited to one quick covert summation. "Did your ambassador explain to you why I am here?"

"Yes, Colonel Benin. I understand you were assigned to investigate the death of that poor fellow—if *fellow* is the right term—we saw so shockingly laid out on the floor of the rotunda the other day." *The best defense is a good offense.* "Did you finally decide it was a suicide?"

Benin's eyes narrowed. "Obviously." But an odd timbre in his voice undercut the statement.

"Well, yes, it was obvious from the exsanguination that the Ba died on the spot, rather than having its throat cut elsewhere and the body transported. But it has occurred to me that if the autopsy showed the Ba was stunned unconscious when it died, it would rather rule out suicide. It's a subtle test—the shock of death tends to cover the shock of stunning—but you can find the traces if you're looking. Was such a test done, do you know?"

"No."

Miles was not sure if he meant it wasn't done, or—no, Benin had to know. "Why not? If I were you, it's the first test I'd ask for. Can you get it done now? Though two days late is

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not ideal."

"The autopsy is over. The Ba has been cremated," Benin stated flatly.

"What, already? Before the case was closed? Who ordered that? Not you, surely."

"Not—Lord Vorkosigan, this is not your concern. This is not what I came to talk with you about," Benin said stiffly, then paused. "Why this morbid interest in the Celestial Lady's late servant?"

"I thought it was the most interesting thing I'd seen since I came to Eta Ceta. It's in my line, you see. I've done civil security cases at home. Murder investigations—" well, one, anyway, "successfully, I might add." Yes, what *was* this Cetagandan officer's experience in such things? The Celestial Garden was such a well-ordered place. "Does this sort of thing happen here often?"

"No." Benin stared at Miles with intensified interest.

So the man might be well-read, but lacked hands-on experience, at least since he'd been promoted to this post. He was damned quick at catching nuances, though. "It seems awfully premature to me, to cremate the victim before the case is closed. There are always late-occurring questions."

"I assure you, Lord Vorkosigan, Ba Lura was not carried unconscious into the funeral rotunda, dead or alive. Even the ceremonial guards would have noticed *that.*" Did the slight spin on his tone hint that perhaps the ceremonial guards were chosen for beauty rather than brains?

"Well, actually, I had a theory," Miles burbled on enthusiastically. "You're just the man to confirm or disprove it for me, too. *Has* anyone testified noticing the Ba enter the rotunda?"

"Not exactly."

"Ah? Yes, and the spot where it lay dead—I don't know what kind of vid coverage you have of the building, but that area *had* to have been occluded. Or it could not have been, what, fifteen, twenty minutes before the body was discovered, right?"

Another thoughtful stare. "You are correct, Lord Vorkosigan. Normally, the entire rotunda is within visual scan, but because of the height and width of the catafalque, two—well, there is some blockage."

"Ah, ha! So how did the Ba know exactly—no, let me rephrase that. Who all could have known about the blind spot at the late Empress's feet? Your own security, and who else? Just how high up did your orders come down from, Colonel Benin? Are you by chance under pressure from above to deliver a quick confirmation of suicide and close your case?"

Benin twitched. "A quick conclusion to this vile interruption of a most solemn occasion is certainly desirable. I desire it as ardently as anyone else. Which brings me to *my* questions for *you,* Lord Vorkosigan. If I may be permitted!"

"Oh. Certainly." Miles paused, then added, just as Benin opened his mouth, "Are you doing this on your own time, then? I admire your dedication."

"No." Benin took a breath, and composed himself again. "Lord Vor-

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kosigan. Our records indicate you left the reception hall to speak privately with a haut-lady."

"Yes. She sent a ba servant with an invitation. I could hardly refuse. Besides, I was curious."

"I can believe that," muttered Benin. "What was the substance of your conversation with the haut Rian Degtiar?"

"Why—surely you monitored it." Surely they had not, or this interview would have taken place two days ago, before Miles had ever left the Celestial Garden—and been a lot less politely conducted, too. But Benin doubtless had a vid of Miles's exit from and entrance to the reception area, and testimony from the little ba escort as well.

"Nevertheless," said Benin neutrally.

"Well—I have to admit, I found the conversation extremely confusing. She's a geneticist, you know."

"Yes."

"I believe her interest in me—excuse me, I find this personally embarrassing. I believe her interest in me was genetic. I am widely rumored to be a mutant. But my physical disabilities are entirely teratogenic, damage done by poison I encountered pre-natally. Not genetic. It's *very important* to me that be clearly understood." Miles thought briefly of his own ImpSec eavesdroppers. "The haut women, apparently, collect unusual natural genetic variations for their research. The haut Rian Degtiar seemed quite disappointed to learn I held nothing of interest, genetically speaking. Or so I gathered. She talked all around the subject—I'm not sure but what she perceived her own interest as being rather, um, questionable. I'm afraid I don't find haut motivations entirely comprehensible." Miles smiled cheerfully. There. That was the vaguest convincing-sounding uncheckable bullshit he could come up with on the spur of the moment, and left a good deal of turning-room for whatever the Colonel had got out of Rian, if anything.

"What *did* interest me, though, was the haut-lady's force bubble," Miles added. "It never touched the ground. She had to be riding in a float-chair in there, I figured."

"They often do," said Benin.

"That's why I asked you about who saw the Ba Lura enter the chamber. Can anyone use a haut-bubble? Or are they keyed in some way to the wearer? And are they as anonymous as they look, or do you have some way of telling them apart?"

"They are keyed to the wearer. And each has its own unique electronic signature."

"Any security measure made by man can be unmade by man. If he has access to the resources."

"I am aware of this fact, Lord Vorkosigan."

"Hm. You see the scenario I'm driving at, of course. Suppose the Ba was stunned elsewhere—a theory that hurried cremation has rendered uncheckable, alas—carried unconscious inside a haut-bubble to the blind spot, and had its throat cut, silently and without a struggle. The bubble glides on. It wouldn't have taken more than fifteen seconds. It wouldn't have required great physical strength on the

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part of the murderer. But I don't know enough about the specs of the bubbles to judge the technical likelihood. And I don't know if any bubbles went in and out—how much traffic *was* there in the funeral rotunda during the time-window we're talking about? There can't have been *that* much. Did any haut-lady bubbles enter and exit?"

Benin sat back, pursing his lips, regarding Miles with keen interest. "You have an alert way of looking at the world, Lord Vorkosigan. Five ba servants, four guards, and six haut-women crossed the chamber during the time in question. The ba have duties there, tending to the botanical arrangements and keeping the chamber perfectly clean. The haut-women frequently come to meditate and pay respects to the Celestial Lady. I have interviewed them all. None report noticing the Ba Lura."

"Then . . . the last one must be lying."

Benin tented his fingers, and stared at them. "It is not quite that simple."

Miles paused. "I despise doing internal investigations, myself," he said at last. "I trust you are documenting every breath you're taking, at this point."

Benin almost smiled. "That's entirely my problem, isn't it?"

Miles was actually beginning to like the man. "You are, considering the venue, of rather low rank for an investigation of this sensitivity, aren't you?"

"That too . . . is my problem."

"Sacrificable."

Benin grimaced. Oh, yes. Nothing Miles had said yet was anything Benin hadn't thought of too—if he'd dared to speak it aloud. Miles decided to continue sprinkling the favors.

"You've won yourself quite a pretty problem in this murder, I'd say, ghem-Colonel," Miles remarked. Neither of them were keeping up the pretense about the suicide any more. "Still, if the method was as I guess, you can deduce quite a lot about the murderer. His rank must be high, his access to internal security great, and—excuse me—he has a *peculiar* sense of humor, for a Cetagandan. The insult to the Empress nearly borders on disloyalty."

"So says an examination of the method," said Benin, in a tone of complaint. "It's motive that troubles me. That harmless old ba has served in the Celestial Garden for decades. Revenge seems most unlikely."

"Mm, perhaps. So if Ba Lura is old news, maybe it's the murderer who's newly arrived. And consider—decades of standing around sopping up secrets—the ba was well-placed to *know* things about persons of extraordinarily high rank. Suppose . . . the ba had been tempted, say, into a spot of blackmail. I would think that a close tracing of Ba Lura's movements these last few days might be revealing. For instance, did the Ba leave the Celestial Garden at any time?"

"That . . . investigation is in prog ress."

"If I were you, I'd jump on that aspect. The Ba might have communicated with its murderer." *Aboard his ship, in orbit, yes.* "The timing is peculiar, you see. To my eye, this mur-

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der shows every sign of having been rushed. If the murderer had had months to plan, he could have done a much better and quieter job. I think he had to make a lot of decisions in a hurry, maybe in that very hour, and some of them were, frankly, bad."

"Not bad enough," sighed Benin. "But you interest me, Lord Vorkosigan."

Miles trusted that wasn't too much of a double entendre. "This sort of thing is meat and drink to me. It's the first chance I've had to talk shop with anyone since I came to Eta Ceta." He favored Benin with a happy smile. "If you have any more questions for me, please feel free to stop by again."

"I don't suppose you would be willing to answer them under fast-penta?" Benin said, without much hope.

"Ah . . ." Miles thought fast, "with Ambassador Vorob'yev's permission, perhaps." Which would not, of course, be forthcoming. Benin's slight smile fully comprehended the delicacy of a refusal-without-refusing.

"In any case, I should be pleased to continue our acquaintance, Lord Vorkosigan."

"Any time. I'll be here nine more days."

Benin gave Miles a penetrating, unreadable look. "Thank you, Lord Vorkosigan."

Miles had about a million more questions for his new victim, but that was all he dared to cram into the opening session. He wanted to project an air of professional interest, not frantic obsession. It was tempting, but dangerous, to think of Benin as an ally. But he was certainly a window into the Celestial Garden. Yeah, a window with eyes that looked back at you. But there had to be some reasonably subtle way to induce Benin to slap himself on the forehead and cry, *Say, I'd better take a closer look at those satrap governors!* He was definitely looking in the correct direction, up. And over his shoulder. A most uncomfortable position in which to work.

How much influence could the satrap governors, all near Imperial relations, put on the Celestial Garden's security? Not too much—they were surely regarded as potential threats. But one might have been building up convenient contacts for a long time now. One might, indeed, have been perfectly loyal till this new temptation. It was a dangerous accusation; Benin had to be right the first time. He wouldn't get a second chance.

Did anyone care about the murder of a ba slave? How much interest did Benin have in abstract justice? If a Cetagandan couldn't be one-up in any other way, holier-than-thou might do. An almost aesthetic drive: the Art of Detection. How much risk was Benin willing to run, how much did he have to lose? Did he have a family, or was he some sort of pure warrior-monk, totally dedicated to his career? To the ghem-Colonel's credit, by the end of the interview Benin had been keeping his eyes on Miles's face because he was interested in what Miles was saying, not because he was not-looking at Miles's body.

Miles rose along with Benin, and paused. "Ghem-Colonel, may I make a personal suggestion?"

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Benin tilted his head in curious permission.

"You have a good reason to suspect you have a little problem somewhere overhead. But you don't know where yet. If I were you, I'd go straight to the top. Make personal contact with your Emperor. It's the only way you can be sure you've capped the murderer."

Did Benin turn pale, beneath his face paint? No way to tell. "*That* high over—Lord Vorkosigan, I can hardly claim casual acquaintance with my celestial master."

"This isn't friendship. It's business, and it's *his* business. If you truly mean to be useful to him, it's time you began. Emperors are only human." Well, Emperor Gregor was. The Cetagandan emperor was haut-human. Miles hoped that still counted. "Ba Lura must have been more to him than a piece of furniture, it served him for over fifty years. Make no accusations, merely request that he protect your investigation from being quashed. Strike first, today, before . . . someone . . . begins to fear your competence." *If you're going to cover your ass, Benin, by-God do it right.*

"I will . . . consider your advice."

"Good hunting," Miles nodded cheerfully, as if it wasn't *his* problem. "Big game is the best. Think of the honor."

Benin bowed himself out with a small, wry smile, to be escorted from the building by the embassy guard.

"See you around," Miles called.

"You may be sure of it." Benin's parting wave was almost, but not quite, a salute.

Miles desire to dissolve into an exhausted puddle on the corridor floor was delayed by the arrival of Vorob'yev, doubtless from his listening post belowstairs, and another man. Ivan hovered behind them with an expression of morose anxiety.

The other man was middle-aged, middle-sized, and wearing the loose body-suit and well cut robes of a Cetagandan ghem-lord, in middle colors. They hung comfortably upon him, but his face was free of colored paint, and the haircut he sported was that of a Barrayaran officer. His eyes were . . . interested.

"A very well-conducted interview, Lord Vorkosigan," said Vorob'yev, relieving Miles's mind. Slightly. An even wager who had interviewed whom, just now.

"Ghem-Colonel Benin obviously has a lot on his mind," said Miles. "Ah. . . ." he glanced at Vorob'yev's companion.

"Allow me to introduce Lord Vorreedi," said the ambassador. "Lord Vorkosigan, of course. Lord Vorreedi is our particular expert in understanding the activities of the ghem-comrades, in all their multitude of arenas."

Which was diplomatic-talk for *Head Spy.* Miles nodded careful greetings. "Pleased to meet you at last, sir."

"And you," Vorreedi returned. "I regret not arriving sooner. The late empress's obsequies were expected to be rather more sedate than this. I didn't know of your keen interest in civil security, Lord Vorkosigan. Would you like us to arrange a tour of the local police organizations?"

"I'm afraid time will not permit. But

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yes, if I hadn't been able to get into a military career, I think police work might have been my next choice."

A uniformed corporal from the embassy's ImpSec office approached, and motioned away his civilian-clothed superior. They conferred in low tones, and the corporal handed over a sheaf of colored papers to the protocol officer, who in turn handed them to the ambassador with a few words. Vorob'yev, his brows climbing, turned to Ivan.

"Lord Vorpatril. Some invitations have arrived for you this morning."

Ivan took the sheets, their colors and perfumes clashing, and leafed through them in puzzlement. "Invitations?"

"Lady Benello invites you to a private dinner, Lady Arvin invites you to a fire-pattern-viewing party—both tonight—and Lady Senden invites you to observe a court-dance practice, this afternoon."

"Who?"

"Lady Senden," the protocol officer supplied, "is Lady Benello's married sister, according to last night's background checks." He gave Ivan an odd look. "Just what did you do to merit this sudden popularity, Lord Vorpatril?"

Ivan held the papers gingerly, smiling thinly, by which Miles deduced he hadn't told the protocol officer quite *everything* about last night's adventure. "I'm not sure, sir." Ivan caught Miles's suffused gaze, and reddened slightly.

Miles craned his neck. "Do any of these women have interesting connections at the Celestial Garden, do you suppose? Or friends who do?"

"*Your* name isn't on these, coz," Ivan pointed out ruthlessly, waving the invitations, all hand-calligraphed in assorted colored inks. A faintly cheerful look was starting in his eyes, displacing his earlier dread.

"Perhaps some more background checks would be in order, my lord?" murmured the protocol officer to the ambassador.

"If you please, Colonel."

The protocol officer left with his corporal. Miles, with a grateful parting wave to Vorob'yev, tagged along after Ivan, who clutched the colored papers firmly and eyed him with suspicion.

"Mine," Ivan asserted, as soon as they were out of earshot. "You have ghem-Colonel Benin, who is more to your taste anyway."

"There are a lot of ghem-women here in the capital who serve as ladies-in-waiting to the haut-women in the Celestial Garden, is all," Miles said. "I'd . . . like to meet that ghem-lady I went walking with last night, for instance, but she didn't give me her name."

"I doubt many of Yenaro's crowd have celestial connections."

"I think this one was an exception. Though the people I *really* want to meet are the satrap governors. Face to face."

"You'd have a better chance at that at one of the official functions."

"Oh, yes. I'm planning on it."

CHAPTER EIGHT

The Celestial Garden was not quite so intimidating on the second visit, Miles

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assured himself. This time they were not lost in a great stream of galactic envoys, but were only a little party of three. Miles, Ambassador Vorob'yev, and Mia Maz were admitted through a side gate, almost privately, and escorted by a single servitor to their destination.

The trio made a good picture. Miles and the ambassador wore their ultra-formal House blacks again. Maz wore black linings and pure white over-robes, combining the two mourning colors, acknowledging the Cetagandan hue without over-stepping the boundaries of haut-privilege. No accident that it also displayed her own dark hair and lively complexion to advantage, and set off her two companions as well. Her dimple flashed with her smile of anticipation and pleasure, directed over Mile's head to Ambassador Vorob'yev. Miles, between them, felt like an unruly kid being escorted firmly by his two parents. Vorob'yev was taking no chances of unauthorized violations of etiquette today.

The offering of the elegiac poetry to the dead empress was not a ceremony normally attended by galactic delegates, with the exception of a very few high-ranking Cetagandan allies. Miles did not qualify on either count, and Vorob'yev had been forced to pull every string he owned to get them this invitation. Ivan had ducked out, pleading weariness from the court-dance practice and the fire-viewing parties of yesterday, and the excuse of four more invitations for this afternoon and evening. It was a suspiciously smug weariness. Miles had let him escape, his sadistic urge to make Ivan sit along with him through what promised to be an interminable afternoon and evening blunted by the reflection that his cousin could do little to contribute to what was essentially an information-gathering expedition. And Ivan might—just might—pick up some useful new contacts among the ghem. Vorob'yev had substituted the Vervani woman, to her obvious delight, and Miles's benefit.

To Miles's relief the ceremony was not carried out in the rotunda, with all its alarming associations, where the Empress's body still lay. Neither did the haut use anything so crass as an auditorium, with people packed in efficient rows. Instead the servitor took them to a—dell, Miles supposed he might call it, a bowl in the garden lined with flowers, plants, and hundreds of little box-seat arrangements overlooking a complex array of daises and platforms at the bottom. As befit their rank, or lack of it, the servitor placed the Barrayaran party in the last and highest row, three-quarters of the way around from the best frontal view. This suited Miles—he could watch nearly the whole audience without being over-looked himself. The low benches were flawless wood, hand-smoothed to a high polish. Mia Maz, bowed gallantly to her seat by Vorob'yev, patted her skirts and stared around, bright-eyed.

Miles stared too, much less bright-eyed—he'd spent a great deal of time the last day peering into his comconsole display, swotting up backward in hopes of finding an end to this tangle.

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The haut were filtering in to their places, men in flowing snowy robes escorting white bubbles. The dell was beginning to resemble a great bank of white climbing roses in a frenzy of bloom. Miles finally saw the purpose of the box seats—it gave room for the bubbles. Was Rian among them?

"Will the women speak first, or how do they organize this?" Miles asked Maz.

"The women won't speak at all, today," said Maz. "They had their own ceremony yesterday. They'll start with the men of lowest rank and work up through the constellations."

Ending with the satrap governors. All of them. Miles settled himself with the patience of a panther in a tree. The men he had come to see were filing into the bottom of the bowl even now. If Miles had owned a tail, it would have twitched. As it was, he stilled a tapping boot.

The eight satrap governors, assisted by their highest-ranking ghem-officers, sank into seats around a raised reserved dais. Miles squinted, wishing for rangefinder binoculars—not that he could have carried them past the tight security. With a twinge of sympathy he wondered what ghem-Colonel Benin was doing right now, and if Cetagandan security went as frantic behind the scenes as Barrayaran security did at any ceremony involving Emperor Gregor. He could just picture them.

But he had what he'd come for—all eight of his suspects, artistically arranged on display. He studied his top four with particular care.

The governor of Mu Ceta was one of the Degtiar constellation, the present emperor's half-uncle, being half-brother to the late empress. Maz too watched closely as he settled his aged body creakily into his seat, and brushed away his attendants with jerky, irritated motions. The governor of Mu Ceta had been at his present post only two years, replacing the governor who had been recalled, and subsequently quietly exiled into retirement, after the Vervain invasion debacle. The man was very old, and very experienced, and had been chosen explicitly to calm Vervani fears of a re-match. Not, Miles thought, the treasonous type. Yet by haut Rian's testimony, every man in the circle had taken at least one step over the line, secretly receiving the unauthorized gene banks.

The governor of Rho Ceta, Barrayar's nearest neighbor, worried Miles a great deal more. The haut Este Rond was middle-aged and vigorous, haut-tall though unusually heavy. His ghem-officer stood well back from his governor's sweeping movements. Rond's general effect was bullish. And he was bullishly tenacious in his efforts, diplomatic and otherwise, to improve Cetaganda's trade access through the Barrayaran-controlled Komarr wormhole jumps. The Rond was one of the more junior haut-constellations, seeking growth. Este Rond was a hot prospect for sure.

The governor of Xi Ceta, Marilac's neighbor, wafted in, proud-nosed. The haut Slyke Giaja was what Miles thought of as a typical haut-lord, tall and lean and faintly effeminate. Arrogant, as befit a younger half-brother of

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the emperor. And dangerous. Young enough to be a possibility, though older than Este Rond.

The youngest suspect, the haut Il-sum Kety, governor of Sigma Ceta, was a mere stripling of forty-five or so. In body type he was much like Slyke Gaija, who was in fact a cousin of different constellation. Haut family trees were even more confusing than the Vors's. It would take a full-time geneticist to keep track of all the semi-siblings.

Eight white bubbles floated into the basin, and took up an arc to the left of the circle of satrap governors. The ghem-officers took up a similar arc to the right. They, Miles realized, were going to get to *stand* through the entire afternoon's ceremony. Being a ghem-general wasn't all blood and beer. But could any of those bubbles be . . .?

"Who are those ladies?" Miles asked Maz, nodding toward the octet.

"They are the satrap governors' consorts."

"I . . . thought the haut did not marry."

"There's no personal relationship implied in the title. They are appointed centrally, just like the governors themselves."

"Not by the governors? What's their function? Social secretaries?"

"Not at all. They are chosen by the empress, to be her representatives in all dealings having to do with the Star Crèche's business. All the haut living on a satrap planet send their genetic contracts through the consorts to the central gene bank here at the Celestial Garden, where the fertilizations and any genetic alterations take place. The consorts also oversee the return of the uterine replicators with the growing fetuses to their parents on the outlying planets. That has to be the strangest cargo run in the Cetagandan empire—once a year for each planet."

"Do the consorts travel back to Eta Ceta once a year, in that case, to personally accompany their charges?"

"Yes."

"Ah." Miles settled back, smiling fixedly. *Now* he saw how the Empress Lisbet had set up her scheme, the living channels she had used to communicate with each satrap governor. If every one of those consorts wasn't in on this plot to her eyebrows, he'd eat his boots. *Sixteen. I have sixteen suspects, not eight. Oh, God.* And he'd come here to cut *down* his list. But it followed logically that Ba Lura's murderer might not have had to borrow or steal a haut-lady's bubble. She might have owned one already. "Do the consort-ladies work closely with their satrap governors?"

Maz shrugged. "I really don't know. Not necessarily, I suppose. Their areas of responsibility are highly segregated."

A major domo took center stage, and made a silent motion. Every voice in the dell went still. Every haut-lord dropped to his knees on padded rests thoughtfully provided in front of the benches. All the white bubbles bobbled—Miles still wondered how many of the haut-women cheated and cut corners at these ceremonies. After an anticipatory hush, the emperor himself arrived, escorted by guards in

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white and blood-red uniforms, zebra-faced, of terrible aspect if you took them seriously. Miles did, not for the face paint, but in certain knowledge of just how nervous and twitchy in the trigger-finger such awesome responsibility could make a man.

It was the first time in his life Miles had seen the Cetagandan emperor in the flesh, and he studied the man as avidly as he had studied the satrap governors. Emperor the haut Fletchir Giaja was tall, lean, hawk-faced like his demi-cousins, his hair still untouched by gray despite his seventy-odd years. A survivor—he had succeeded to his rank at a fantastically young age for a Cetagandan, less than thirty, and held on through a wobbly youth to an apparently iron-secure mid-life. He seated himself with great assurance and grace of movement, serene and confident. Ringed by bowing traitors. Miles's nostrils flared, and he took a breath, dizzy with irony. At another signal from the major domo, everyone regained their seats, still in that remarkable silence.

The presentation of the elegiac poems in honor of the late haut Lisbet Degtiar began with the heads of the lowest-ranking constellations present. Each poem had to fit into one of half a dozen correct formal types, all mercifully short. Miles was extremely impressed with the elegance, beauty, and apparent deep feeling of about the first ten offerings. The recitation had to be one of those great formal ordeals, like taking an oath or getting married, in which preparations wildly outmassed the moment of actualization. Great care was taken with movement, voice, and imperceptible variations of what to Miles's eye were identical white dress robes. But gradually, Miles began to be aware of stock phrases, repeated ideas; by the thirtieth man, his eyes were starting to glaze over. More than ever Miles wished Ivan by his side, suffering along with him.

Maz whispered an occasional interpretation or gloss, which helped fend off creeping drowsiness—Miles had not slept well last night. The satrap governors were all doing good imitations of men stuffed and mounted, except for the ancient governor of Mu Ceta, who slumped in open boredom, and watched through sardonic slitted eyes as his juniors, i.e., everyone else there, performed with various degrees of flop-sweat. The older and more experienced men, as they came on, at least had better deliveries, if not necessarily better poems.

Miles meditated on the character of Lord X, trying to match it with one of the eight faces ranged before him. The murderer/traitor was something of tactical genius. He had been presented with an unanticipated opportunity to gain power, had committed rapidly to an all-out effort, evolved a plan, and struck. How fast? The first satrap governor had arrived in person only ten days before Miles and Ivan had, the last only four days before. Yenaro, the embassy's ImpSec office had finally reported, had put his sculpture together in just two days from designs delivered from an unknown source, working his minions around the clock. Ba Lura could only have been suborned since its mis-

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tress's death, not quite three weeks ago.

The aged haut thought nothing of taking on plans that took decades to mature, with can't-lose security. Witness the old empress herself. They experienced time differently than Miles did, he was fairly sure. This whole chain of events smelled . . . young. Or young at heart.

Miles's opponent must be in an interesting frame of mind just now. He was a man of action and decision. But now he had to lie quiet and do nothing to draw attention to himself, even as it began to look more and more like Ba Lura's death was not going to pass as planned as a suicide. He had to sit tight on his bank and the Great Key till the funeral was over, and glide softly back to his planetary base—because he couldn't start the revolt from here; he'd prepared nothing in advance, before he'd left home.

So would he send the Great Key on, or keep it with him? If he'd sent it back to his satrapy already, Miles was in deep trouble. Well, deeper trouble. Would the governor take the risk of losing the powerful tokens in transit? Surely not.

The droning amateur poets were getting to Miles. He found his subconscious mind not working along with the rest of it as it should, but going off on its own tangent. A poem of his own in honor of the late empress formed, unbidden, in his brain.

A Degtiar empress named Lisbet
trapped a satrap lord neatly in his net.
Enticed into treason
for all the wrong reasons,
He'll soon have a crash with his kismet.

He choked down a genuinely horrible impulse to bounce down to the center of the dell and declaim his poetic offering to the assembled haut multitude, just to see what would happen.

Mia Maz glanced aside in concern at his muffled snort. "Are you all right?"

"Yes. Sorry," he whispered. "I'm just having an attack of limericks."

Her eyes widened, and she bit her lip; only her deepening dimple betrayed her. *"Shhh,"* she said, with feeling.

The ceremony went on uninterrupted. Alas, there was all too much time to evolve more verse, of equal artistic merit. He gazed out at the banks of white bubbles.

A beautiful lady named Rian
hypnotized a Vor scion.
The little defective
thinks he's a detective,
but instead will be fed to the lion. . . .

How did the haut live through these things? Had they bioengineered their bladders to some inhuman capacity, along with all the other rumored changes?

Fortunately, before Miles could think of two rhymes for *Vorob'yev,* the first satrap governor arose to take his place on the speaker's dais. Miles came abruptly awake.

The satrap governors' poems were all excellent, all in the most difficult forms—and, Maz informed Miles in a whisper, mostly ghost-written by the best haut-women poets in the Celestial Garden. Rank hath its privileges.

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But try as he might, Miles could not read any useful sinister double meanings into them—his suspect was not using this moment to publicly confess his crimes, put the wind up his enemies, or any of the other really interesting possibilities. Miles was almost surprised. The placement of Ba Lura's body suggested Lord X had a weakness for the baroque in his plotting, when the simple would have done better. Making an Art of it?

The emperor sat through it with unruffled solemn calm. The satrap governors all received polite nods of thanks from the chief mourner for their elegant praises. Miles wondered if Benin had taken his advice, and spoken with his master yet. He hoped so.

And then, abruptly, the literary ordeal was over. Miles suppressed an impulse to applaud; that was apparently Not Done. The major domo came out and made another cryptic gesture, at which everyone went to their knees again; the emperor and his guards decamped, followed by the consort bubbles, the satrap governors, and their ghem-officers. Then everyone else was freed—to find a bathroom, Miles trusted.

The haut race might have divested itself of the traditional meanings and functions of sexuality, but they were still human enough to make the sharing of food part of life's basic ceremonies. In their own way. Trays of meat were sculptured into flowers. Vegetables masqueraded as crustaceans, and fruit as tiny animals. Miles stared thoughtfully at the plate of simple boiled rice on the buffet table. Every grain had been individually hand-arranged in an elaborate spiral pattern. He almost tripped over his own boots, boggling at it. He controlled his bemusement and tried to refocus on the business at hand.

The informal—by Celestial Garden standards—refreshments were served in a long pavilion open as usual to the garden, presently lit in a warm afternoon glow that invited relaxation. The haut-ladies in their bubbles had evidently gone elsewhere—someplace where they could drop their bubbles to eat, presumably. This was the most exclusive of several post-poetry buffet sites scattered around the Celestial Garden. The emperor himself was somewhere at the other end of the graceful building. Miles wasn't quite sure how Vorob'yev had got them in, but the man deserved a commendation for extraordinary service. Maz, eyes alight, hand on Vorob'yev's arm, was clearly in some sort of sociologist's heaven.

"Here we go," murmured Vorob'yev, and Miles went heads-up. The haut Este Rond's party was entering the crowded pavilion. The other haut, not knowing what to do about these out-of-place outlanders, had been trying to pretend the Barrayarans were invisible ever since they'd arrived. Este Rond did not have that option. The beefy, white-robed satrap governor, his painted and uniformed ghem-general by his side, paused to greet his Barrayaran neighbors.

A white-robed woman, unusual in this heavily-male gathering, trailed the Rond's ghem-general. Her silver-blonde hair was gathered in a looping

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queue down her back to her ankles, and she stood with downcast eyes, not speaking. She was much older than Rian, but certainly a haut woman—*God* they aged well. She must be the Rond's ghem-general's haut-wife—any officer destined to such high planetary rank would have been expected to win one long ago.

Maz was giving Miles some inexplicable but urgent signal—a tiny head shake, and a *No, no!* formed silently on her lips. What was she trying to say? The haut-wife, apparently, did not speak unless spoken to—Miles had never seen anyone's body-language express such extraordinary reserve and containment, not even the haut Rian's.

Governor Rond and Vorob'yev exchanged elaborate courtesies, by which Miles gathered that the Rond had been their ticket in. Vorob'yev culminated his diplomatic coup by introducing Miles. "The lieutenant takes a very gratifying interest in the finer points of Cetagandan culture," Vorob'yev recommended him to the governor's attention.

The haut Rond nodded cordially; when Vorob'yev recommended someone it seemed even Cetagandan haut lords attended.

"I was sent to learn, as well as serve, sir. It is my duty and my pleasure." Miles favored the haut-governor with a precisely calculated bow. "And I must say, I have certainly been having learning experiences." Miles tried by his edged smile to put as much double-spin on his words as possible.

The Rond smiled back, cool-eyed. But then, if Este Rond was Lord X, he ought to be cool. They exchanged a few empty pleasantries about the diplomatic life, then Miles ventured boldly, "Would you be so kind, haut Rond, to introduce me to Governor haut Ilsum Kety?"

A razor-thin smile twitched the Rond's lips, and he glanced across the room at his fellow-governor and genetic superior. "Why, certainly, Lord Vorkosigan." If the Rond was going to be stuck with these outlanders, Miles gathered, he'd be happy to share the embarrassment.

The Rond shepherded Miles over. Vorob'yev was left talking with the Rho Cetan ghem-general, who was taking a sincere professional interest in his potential enemies. Vorob'yev shot Miles a warning not-quite-glower, just a slight creasing of his eyebrows; Miles opened his hand, down at his side, in an *I'll-be-good* promise.

As soon as they were out of the ambassadors' earshot, Miles murmured to the Rond, "We know about Yenaro, you know."

"I beg your pardon?" said the Rond, in realistic-sounding bafflement, and then they arrived at the haut Ilsum Kety's little group.

Close-up, Kety seemed even taller and leaner than he had at a distance at the poetry readings. He had cool chiseled features very much in the haut mold—hawk-noses had been the style ever since Fletchir Giaja has ascended the throne. A bit of silver-gray set off the dark hair at his temples. Since the man was only in his mid-forties, and haut to boot . . . by God,

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yes. The touch of frost was quite perfect, but it had to have been artificially produced, Miles realized with well-concealed inner amusement. In a world where the old men had it all, there was no social benefit to a youthful appearance when one actually *was* young.

Kety, too, was attended by his ghem-general, who also kept a haut-wife on stand-by. Miles tried not to let his eyes bug out too obviously. She was extraordinary even by haut-standards. Her hair was a rich dark chocolate color, parted in the middle and gathered in a thick braid that trailed down her back to actually coil upon the floor. Her skin was vanilla cream. Her eyes, widening slightly as she glanced down at Miles approaching by the Rond's side, were an astonishing light cinnamon color, large and liquid. A complete confection indeed, wholly edible and scarcely older than Rian. Miles was quietly grateful for his previous exposure to Rian, which helped a great deal toward keeping him on his feet and not crawling on his knees toward her right now.

Ilsum Kety clearly had no time for or interest in outlanders, but for whatever reason did not care or dare to offend the Rond; Miles managed a brief exchange of formal greetings with him. The Rond took the opportunity to skim Miles off his hands and escape to the buffet.

The irritated Kety was failing to perform his social duties. Miles took matters into his own hands, and directed a half-bow at Kety's ghem-general. The general, at least, was of the customary Cetagandan age for his position, i.e., antique. "General Chilian, sir. I have studied you in my history texts. It is an honor to meet you. And your fine lady. I don't believe I know her name." He smiled hopefully at her.

Chilian's brows, going up, drew back down in a slight frown. "Lord Vorkosigan," he acknowledged shortly. But he didn't take up the hint. After a tiny glint of distaste in Miles's direction, the haut woman stood as if she weren't there, or at least wishing so. The two men seemed to treat her as if she were invisible.

So if Kety were Lord X, what must be going through his mind right now, as he found himself cornered by his intended victim? He'd planted the false rod on the Barrayaran party, set up the Ba Lura to tell Rian and convince her to make accusations of theft, killed the Ba, and waited for the results. Which had been—a resounding silence. Rian had apparently done nothing, not said a word to anyone. Did Kety wonder if he'd killed Lura too soon after all, before it had made a chance to confess its loss? It must be very puzzling for the man. But nothing, not a twitch, showed on his haut face. Which would, of course, also be the case if the governor were totally innocent.

Miles smiled affably at the haut Ilsum Kety. "I understand we have a mutual hobby, governor," he purred.

"Oh?" said Kety unencouragingly.

"An interest in the Cetagandan Imperial regalia. Such a fascinating set of artifacts, and so evocative of the history and culture of the haut race, don't you think? And its future."

Kety stared at him blankly. "I would

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not regard that as a pastime. Nor a suitable interest for an outlander."

"It's a military officer's duty to know his enemies."

"I would not know. Those tasks belong to the ghem."

"Such as your friend Lord Yenaro? A slender reed for you to lean on, governor, I'm afraid you are about to find."

Kety's pale brow wrinkled. "Who?"

Miles sighed inwardly, wishing he could flood the entire pavilion with fast-penta. The haut were all so damned controlled, they looked like they were lying even when they weren't. "I wonder, haut Kety, if you would introduce me to Governor haut Slyke Gaija. As an imperial relation of sorts myself, I can't help feeling he is something of my opposite number."

The haut Kety blinked, surprised into honesty. "I doubt *Slyke* would think so. . . ." By the look on his face he was balancing the annoyance to Prince Slyke Giaja of inflicting the outlander on him, versus the relief of being rid of Miles himself. Self-interest won, up to a point; the haut Kety motioned ghem-General Chilian nearer, and dispatched him to gain permission for the transfer. With a polite farewell and thank you to Kety, Miles trailed after the ghem-general, hoping to take advantage of any indecision to press his suit. Imperial princes were not likely to make themselves so readily accessible as ordinary haut-governors.

"General, if the haut Slyke cannot speak with me, would you deliver a short message to him?" Miles tried to keep his voice even, despite his limping stride; Chilian was not shortening his steps in favor to the Barrayaran guest. "Just three words."

Chilian shrugged. "I suppose I can."

"Tell him . . . Yenaro is ours. Just that."

The general's brows rose at this cryptic utterance. "Very well."

The message of course, would be repeated later to Cetagandan Imperial Security. Miles didn't mind the idea of Cetagandan Imperial Security taking a closer look at Lord Yenaro.

The haut Slyke Gaija was sitting with a small group of men, both ghem and haut, on the far side of the pavilion. Unusually, the party also included a white bubble, hovering near the Prince. Attendant upon it was a ghem-lady Miles recognized, despite the voluminous formal white robes she wore today—the woman who'd been sent to fetch him at Yenaro's party. The ghem-woman glanced across at him approaching, stared briefly, then looked resolutely away. So who was in the bubble? Rian? Slyke's consort? Someone else entirely?

Kety's ghem-general bent to murmur in his ear. Slyke Giaja glanced across at Miles, frowned, and shook his head. Chilian shrugged, and bent to murmur again. Miles, watching his lips move, saw his message or something very like it being delivered—the word *Yenaro* was quite distinctive. Slyke's face betrayed no expression at all. He waved the ghem-general away.

General Chilian returned to Miles's side. "The haut Slyke is too busy to

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see you at this time," he reported blandly.

"Thank you anyway," Miles intoned, equally blandly. The general nodded acknowledgement, and went back to his master.

Miles stared around, wondering how to leverage access to his next prospect. The Mu Cetan governor was not present; he'd probably departed directly from the garden amphitheater to take a nap.

Mia Maz drifted up to Miles, smiling, curiosity in her eyes. "Finding any good conversations, Lord Vorkosigan?" she asked.

"Not so far," he admitted ruefully. "Yourself?"

"I would not presume. I've mostly been listening."

"One learns more that way."

"Yes. Listening is the invisible conversational coup. I feel quite smug."

"What have you learned?"

"The haut topic at this party is each other's poetry, which they are slicing up along strict lines of dominance. By some coincidence everyone is agreeing that the men of higher rank had the better offerings."

"I couldn't tell the difference, myself."

"Oh, but we are not haut."

"Why were you wagging your eyebrows at me a while ago?" Miles asked.

"I was trying to warn you about a rare point of Cetagandan etiquette. How you are supposed to behave when you encounter a haut-woman outside of her bubble."

"It was . . . the first time I'd ever seen one," he lied strategically. "Did I do all right?"

"Hm, barely. You see, the haut women lose the privilege of the force-shields when they marry out of the genome into the ghem-rank. They become as ghem-women—sort of. But the loss of the shield is considered a great loss of face. So the polite thing to do is to behave as if the bubble were still there. You must never directly address a haut-wife, even if she's standing right in front of you. Put all inquiries through her ghem-husband, and wait for him to transmit the replies."

"I . . . didn't say anything to them."

"Oh, good. And you must never stare directly at them, either, I'm afraid."

"I thought the men were being rude, to close the women out of the conversation."

"Absolutely not. They were being most polite, Cetagandan style."

"Oh. But the way they carry themselves, the women might as well still be in the bubbles. Virtual bubbles."

"That's the idea, yes."

"Do the same rules go for . . . haut women who still have the privilege of their bubbles?"

"I have no idea. I cannot imagine a haut-woman talking face to face with an outlander."

Miles became aware of a ghostly gray presence at his elbow, and tried not to jump. It was the haut Rian Degtiar's little ba servant. The ba passed into the room without a ripple, ignored by its inhabitants. Miles's heart began to race, a response he muffled in a polite nod at the servitor.

"Lord Vorkosigan. My lady wishes to speak with you," said the ba. Maz's

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eyes widened.

"Thank you, I would be pleased," Miles responded. "Ah. . . ." he glanced around for Ambassador Vorob'yev, who was still being buttonholed by the Rho Cetan ghem-general. Good. Permissions not requested could not be denied. "Maz, would you be so kind as to tell the ambassador I've gone to speak with a lady. Mm . . . I may be some time at it. Go on without me. I'll catch up with you back at the embassy, if necessary."

"I don't think—" began Maz doubtfully, but Miles was already turning away. He shot her a smile over his shoulder and a cheerful little wave as he followed the ba out of the pavilion.

CHAPTER NINE

The little ba, its expression devoid as ever of any comment on its mistress's affairs, led Miles on a lengthy walk through the garden's winding paths, around ponds and along tiny, exquisite artificial streams. Miles almost stopped to gape at an emerald green lawn populated by a flock of ruby-red peacocks the size of songbirds, slowly stalking about. A sunny spot on a ledge a little farther on was occupied by something resembling a spherical cat, or perhaps a bouquet of cat-fur, soft, white . . . yes, there was an animal in there; a pair of turquoise blue eyes blinked once at him from the fuzz, and closed again in perfect indolence.

Miles did not attempt conversation or questions. He might not have been personally monitored by Cetagandan Imperial Security on his last trip to the Celestial Garden, when he'd been mixed in with a thousand other galactic delegates; this was certainly not the case today. He prayed Rian would realize this. Lisbet would have. He could only hope Rian had inherited Lisbet's safe zones and procedures, along with the Great Key and her genetic mission.

A white bubble waited in a cloistered walkway. The ba bowed to it and departed.

Miles cleared his throat. "Good evening, milady. You asked to see me? How may I serve you?" He kept his greeting as general as possible. For all he knew it was ghem-Colonel Benin and a voice-filter inside that damned blank sphere.

Rian's voice or a good imitation murmured, "Lord Vorkosigan. You expressed an interest in genetic matters. I thought you would care for a short tour."

Good. They were monitored, and she knew it. He suppressed the tiny part of himself that had been hoping against all reason for a love-affair cover, and answered, "Indeed, milady. All medical procedures interest me. I feel the corrections to my own damage were extremely incomplete. I'm always looking for new hopes and chances, whenever I have an opportunity to visit more advanced galactic societies."

He paced along beside her floating sphere, trying, and failing, to keep track of the twists and turns of their route, through archways and other buildings. He managed a suitably admiring comment or two on the passing scenery, so their silence would not be too obvious. He'd walked

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about a kilometer from the Emperor's buffet, he gauged, though certainly not in a straight line, when they came to a long, low white building. Despite the usual charming landscaping, it had "biocontrol" written all over it, in the details of its window seals and door-locks. The airlock required complicated encodations from Rian, though once it had identified her, it admitted him under her aegis without a murmur of protest.

She led him through surprisingly un-labyrinthine corridors to a spacious office. It was the most utilitarian, least artistic chamber he'd yet seen in the Celestial Garden. One entire wall was glass, overlooking a long room that had a lot more in common with galactic-standard bio-labs than with the garden outside. Form follows function, and this place was bristling with function: purpose, not the languid ease of the pavilions. It was presently deserted, shut down, but for a lone ba servitor moving among the benches doing some sort of meticulous janitorial task. But of course. No haut genetic contracts were approved or, presumably, carried out during the period of mourning for the Celestial Lady, putative mistress of this domain. A screaming-bird pattern decorated the surface of a comconsole, and hovered above several cabinet-locks. He was standing in the center of the Star Crèche.

The bubble settled by one wall, and vanished without a pop. The haut Rian Degtiar rose from her float-chair.

Her ebony hair today was bound up in thick loops, tumbling no farther than her waist. Her pure white robes were only calf-length, two simple layers comfortably draped over a white body suit that covered her from neck to white-slippered toe. More woman, less icon, and yet . . . Miles had hoped repeated exposure to her beauty might build up an immunity in him to the mind-numbing effect of her. Obviously, he would need more exposure than this. Lots more. Lots and lots and—*stop it. Don't be more of a idiot than you have to be.*

"We can talk here," she said, gliding to a station chair beside the comconsole desk and settling herself in it. Her simplest movements were like dance. She nodded to another station chair across from hers, and Miles lurched into it with a strained smile, intensely conscious that his boots barely touched the floor. Rian seemed as direct as the ghem-generals' wives were closed. Was the Star Crèche itself a sort of psychological force-bubble for her? Or did she merely consider him so sub-human as to be completely non-threatening, as incapable as a pet animal of judging her?

"I . . . trust you are correct," Miles said, "but won't there be repercussions from your security for bringing me in here?"

She shrugged. "If they wish, they can request the Emperor to reprimand me."

"They cannot, er, reprimand you directly?"

"No."

The statement was flat, factual. Miles hoped she was not being overly optimistic. And yet . . . by the lift of her chin, the set of her shoulders, it was clear that the haut Rian Degtiar,

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Handmaiden of the Star Crèche, firmly believed that within these walls *she* was empress. For the next eight days, anyway.

"I trust this is important. And brief. Or I'm going to emerge to find ghem-Colonel Benin waiting for an exit interview."

"It's important." Her blue eyes seemed to blaze. "I know which satrap governor is the traitor, now!"

"Excellent! That was fast. Uh . . . How?"

"The Key was, as you said, a decoy. False and empty. As you knew." Suspicion still glinted in her eye, lightning upon him.

"By reason alone, milady. Do you have evidence?"

"Of a sort." She leaned forward intently. "Yesterday, Prince Slyke Giaja had his consort bring him to the Star Crèche. For a tour, he pretended. He insisted I produce the Empress's regalia, for his inspection. His face said nothing, but he gazed upon the collection for a long time, before turning away, as if satisfied. He congratulated me upon my loyal work, and left immediately thereafter."

Slyke Giaja was certainly on Mile's short list. Two data points did not quite make a triangulation, but it was certainly better than nothing. "He didn't ask to see the Key demonstrated, to prove it worked?"

"No."

"He knew, then." *Maybe, maybe* . . . . "I bet we gave him food for thought, seeing his decoy sitting there all demure. I wonder which way he's going to jump next? Does he realize *you* know it's a decoy, or does he think you've been fooled?"

"I could not tell."

It wasn't just him, Miles thought with glum relief, even the haut couldn't read other haut. "He must realize he has only to wait eight days, and the truth will come out, the first time your successor tries to use the Great Key. Or if not the truth, certainly the accusation against Barrayar. But is that his plan?"

"I don't know what his plan is."

"He wants to involve Barrayar somehow, that I'm sure of. Perhaps even provoke armed conflict between our states."

"This . . ." Rian turned one hand, curled as if around the stolen Great Key, "would be an outrage, but surely . . . not cause enough for war."

"Mm. This may only be Part One. This pis—angers you at us, logically. Part Two ought to be something that angers us at you." An uncomfortable new realization. Clearly, Lord X—Slyke Gaija?—was not done yet. "Even if I'd handed the Key back in that first hour—which I don't think was his script—we still could not have proved we didn't switch it. I wish we hadn't jumped the Ba Lura. I'd give anything to know what story it was *supposed* to have primed us with."

"I wish you hadn't either," said Rian rather tartly, settling back in her station chair and twitching her vest, the first un-purposive move Miles had ever seen her make.

Miles's lips twisted in brief embarrassment. "But—this is important—the consorts, the satrap governors' consorts. You never told

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me about them. They're in on this, aren't they? Why not on both sides?"

She nodded reluctant acknowledgment. "But I do not suspect any of them of being involved in this treason. That would be . . . unthinkable."

"But surely your Celestial Lady used them—why unthinkable? I mean, here a woman's got a chance to make herself an instant empress, right along with her governor. Or maybe even independently of her governor."

The haut Rian Degtiar shook her head. "No. The consorts do not belong to *them.* They belong to *us.*"

Miles blinked, slightly dizzy. "Them. The men. Us. The women. Right?"

"The haut women are keepers—" she broke off, evidently hopeless of explaining it to an outlander barbarian. "It cannot be Slyke Giaja's consort."

"I'm sorry. I don't understand."

"It's . . . a matter of the haut genome. Slyke Giaja is attempting to take something to which he has no right. It is not that he attempts to usurp the emperor. That is his proper part. It's that he attempts to usurp the *empress.* A vileness beyond. . . . The haut genome is ours and ours alone. In this he betrays not the empire, which is nothing, but the haut, which is everything."

"But the consorts are in favor, presumably, of decentralizing the haut genome."

"Of course. They are all my Celestial Lady's appointees."

"Do they . . . hm. Do they rotate every five years along with their governors? Or independently of them?"

"They are appointed for life, and removed only by the Celestial Lady's direct order."

The consorts seemed powerful allies in the heart of the enemy camp, if only Rian could activate them on her behalf. But she dared not do so, alas, if one of them was herself a traitor. Miles thought bad words to himself.

"The empire," he pointed out, "is the support of the haut. Hardly *nothing,* even from a genetic point of view. The, er, prey to predator ratio is quite high."

She did not smile at his weak zoological joke. He probably ought not to treat her to a recitation of his limericks, then, either. He tried again. "Surely the Empress Lisbet did not mean to instantly fragment the support of the haut."

"No. Not this fast. Maybe not even in this generation," admitted Rian.

Ah. That made more sense, a timing much more in an old haut-lady's style. "But now her plot has been hijacked to another's purpose. Someone with short-term, personal goals, someone she did not foresee." He moistened his lips, and forged on. "I believe your Celestial Lady's plans have fractured at their weak spot. The emperor protects the haut-women's control of the haut-genome; in turn you lend him legitimacy. A mutual support in both your interests. The satrap governors have no such motive. You can't give power away and keep it simultaneously."

Her exquisite lips thinned unhappily, but she did not deny the point.

Miles took a deep breath. "It's not

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in Barrayar's interests for Slyke Giaja to succeed in his power-grab. So far, I can serve you in this, milady. But it's not in Barrayar's interests for the Cetagandan Empire to be destabilized in the way your empress planned, either. I think I see how to foil Slyke. But in turn you must give up your attempt to carry out your mistress's posthumous vision." At her astonished look he added weakly, "At least for now."

"How . . . would you foil Prince Slyke?" she asked slowly.

"Penetrate his ship. Retrieve the real Great Key. Replace it again with the decoy, if possible. If we're lucky he might not even realize the substitution till he got home, and then what could he do about it? You hand over the Great Key to your successor, and it all passes away as smoothly as if it had never happened. Neither party can accuse the other without incriminating himself." *Or herself.* "I think it is, in all, the best outcome that can be humanly achieved. Any other scenario leads to disaster, of one sort or another. If we do nothing, the plot comes out in eight days regardless, and Barrayar gets framed. If I try and fail . . . at least I can't make it any worse." *Are you sure of that?*

"How could you get aboard Slyke's ship?"

"I have an idea or two. The governor's consorts—and their ghem-ladies, and their servitors—can they go up and down from orbit freely?"

One porcelain hand touched her throat. "More or less, yes."

"So you get a lady with legitimate access, preferably someone relatively inconspicuous, to take me up. Not as myself, of course, I'd have to be disguised somehow. Once I'm aboard, I can take it from there. This gives us a problem of trust. Who could you trust? I don't suppose you yourself could?"

"I haven't left the capital for . . . several years."

"You would not qualify as inconspicuous, then. Besides, Slyke Giaja has to be keeping a close eye on you. What about that ghem-lady you sent to meet me at Yenaro's party?"

Rian was looking decidedly unhappy. "Someone in the consort's train would be a better choice," she said reluctantly.

"The alternative," he pointed out coolly, "would be to let *Cetagandan* security do the job. Nailing Slyke would automatically clear Barrayar, and *my* problem would be solved."

Well . . . not quite. Slyke Giaja, if Lord X, was the man who'd somehow jiggered the orbital station's traffic control, and who'd known *just* what security blind spot would hold Ba Lura's body. Slyke Gaija had more security access than he bloody ought to. Was it so certain that Cetagandan Security would be able to pull off a *surprise* raid on the Imperial prince's ship?

"How would *you* disguise yourself?" she asked.

He tried to convince himself her tone was merely taken aback, not scornful. "As a ba servitor, probably. Some of them are as short as I am. And you haut treat those people like they're invisible. Blind and deaf, too."

"No man would disguise himself as a ba!"

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"So much the better, then." He grinned ironically at her reaction.

Her comconsole chimed. She stared at it in brief, astonished annoyance, then touched its code pad. The face of a fit-looking middle-aged man formed over the vid-plate. He wore a Cetagandan Security officer's ordinary uniform, but he was no one Miles recognized. Gray eyes glinted like granite chips from freshly-applied zebra-striped face paint. Miles quailed, and glanced around quickly—he was out of range of the vid-pick up, at least.

"Haut Rian," the man nodded deferentially.

"Ghem-Colonel Millisor," Rian acknowledged. "I ordered my comconsole blocked to incoming calls. This is not a convenient time to speak." She kept her eyes from darting to Miles.

"I used the emergency override. I've been trying to reach you for some time. My apologies, Haut, for intruding upon your mourning for the Celestial Lady, but she would have been the first to wish it. We have succeeded in tracking the lost L-X-10-Terran-C to Jackson's Whole. I need the authorization of the Star Crèche to pursue out of the Empire with all due force. I had understood that the recovery of the L-X-10-Terran-C was one of our late Lady's highest priorities. After the field tests she was considering it as an addition to the haut genome itself."

"This *was* true, ghem-Colonel, but . . . well, yes, it still should be recovered. Just a moment." Rian rose, went to one of the cabinets, and unlocked it with the encode-ring, fished from its chain around her neck. She rummaged within, and removed a clear block about fifteen centimeters on a side with the scarlet bird pattern incised upon the top, returned to her desk, and place it over the comconsole's read-pad. She tapped out some codes, and a light flashed briefly within the block. "Very well, ghem-Colonel. I leave it entirely to your judgment. You knew our late Lady's mind on this. You are fully authorized, and may draw your resources as needed from the Star Crèche's special fund."

"I thank you, Haut. I will report our progress." The ghem-colonel nodded, and keyed off.

"What was that all about?" Miles asked brightly, trying not to look too predatory.

Rian frowned at him. "Some old internal business of the haut genome. It has nothing to do with you or Barrayar, or the present crisis, I assure you. Life does go on, you know."

"So it does." Miles smiled affably, as if fully satisfied. Mentally, he filed the conversation away verbatim. It might make a nice tidbit to distract Simon Illyan with, later. He had a bad feeling he was going to need some major distractions for Illyan, when he got home.

Rian put the Great Seal of the Star Crèche carefully away again in its locked cabinet, and returned to her station-chair.

"So can you do it?" Miles pursued. "Have a lady you trust meet me, with a ba servitor's uniform and real ID's, the false rod, and some way to check

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the real one? And send her up to Prince Slyke's ship on some valid pretext, with me in her train? And *when?*"

"I'm . . . not sure when."

"We have to set the meeting in advance, this time. If I'm going to go wandering away from my embassy's supervision for several hours, you can't just call me away at random. I have to cover my own a—concoct a cover story for my own security, too. Do you have a copy of my official schedule? You must, or we could not have connected before. I think we should rendezvous outside the Celestial Garden, this time, for starters. I'm going to be at something called the Bioestheties Exhibit tomorrow afternoon. I think I could make up an excuse to get away from there, maybe with Ivan's help."

"So soon. . . ."

"Not soon enough, in my view. There's not much time left. And we have to allow for the possibility that the first attempt may have to be aborted for some reason. You . . . do realize, your evidence against Prince Slyke is suggestive only. Not conclusive."

"But it's all I have, so far."

"I understand. But we need all the margin we can get. In case we have to go back for a second pass."

"Yes . . . you're right. . . ." She took a breath, frowning anxiously. "Very well, Lord Vorkosigan. I shall help you make this attempt."

"Do *you* have any guesses where on his ship Prince Slyke might be inclined to store the Great Key? It's a small object, and a big ship, after all. My first guess would be his personal quarters. Once aboard, is there any way of detecting the Great Key's location? I don't suppose we're so fortunate as to have a screamer circuit on it?"

"Not as such. Its internal power system is an old and very rare design, though. At short range, it might be possible to pick up with an appropriate sensor. I will see that my lady brings you one, and anything else I can think of."

"Every little bit helps." There. They were in motion at last. He suppressed a wild impulse to beg her to throw it all over and flee away with him to Barrayar. Could he even smuggle her out of the Cetagandan Empire? Surely it was no more miraculous a task than the one now before him. Yes, and what would be the effect on his career, not to mention his father's, of installing a refugee Cetagandan hautwoman and close relative of Emperor Fletchir Giaja's in Vorkosigan House? And how much trouble would trail him? He thought fleetingly of the story of the Trojan War.

Still, it would have been flattering, if she had indeed been trying to suborn him, if she'd at least tried a little harder. She had not lifted a finger to attract him; not an eyebrow arched in false invitation. She seemed straightforward to the point of naiveté, to his own ImpSec-trained, naturally-convoluted mind. When someone fell deeply and hopelessly in love with somebody, that somebody ought at least to have the courtesy to notice. . . .

The key word, boy, is hopelessly.

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Keep it in mind.

They shared no love, he and Rian, nor the chance of any. And no goals. But they did share an enemy. It would have to do.

Rian rose in dismissal; Miles scrambled up, too, saying, "Has ghem-Colonel Benin caught up with you yet? He was assigned to investigate the death of Ba Lura, you know."

"So I understood. He has twice requested an audience with me. I have not yet granted his request. He seems . . . persistent."

"Thank God. We've still got a chance to get our stories straight." Miles quickly summed up his own interview with Benin, with special emphasis on his fictional first conversation with Rian. "We need to make up a consistent account of this visit, too. I think he'll be back. I rather encouraged him, I'm afraid. I didn't guess Prince Slyke would give himself away to you so quickly."

Rian nodded, walked to the window-wall, and, pointing to various sites within the laboratory, gave Miles a brief description of the tour she'd given Prince Slyke yesterday. "Will that do?"

"Nicely, thanks. You can tell him I asked a lot of medical questions about . . . correcting various physical disabilities, and that you couldn't help me much, that I'd come to the wrong store." He could not help adding, "There's nothing wrong with my DNA, you know. All my damage was teratogenic. Outside your purview and all that."

Her face, always mask-like in its beauty, seemed to grow a shade more expressionless. Rattled, he added, "You Cetagandans spend an inordinate amount of time on appearances. Surely you've encountered false appearances before." *Stop it, shut up now.*

She opened a hand, acknowledging without agreeing or disagreeing, and returned to her bubble. Worn out, and not trusting his tongue any further, Miles paced silently beside it back to the main entrance.

They exited into a cool and luminous artificial dusk. A few pale stars shone in the apparently-boundless dark blue hemisphere above. Sitting in a row on a bench across the entry walk from the Star Crèche were Mia Maz, Ambassador Vorob'yev, and ghem-Colonel Benin, apparently chatting amiably. They all looked up at Miles's appearance, and Vorob'yev's and Benin's smiles, at least, seemed to grow a shade less amiable. Miles almost turned around to flee back inside.

Rian evidently felt some similar emotion, for the voice from her bubble murmured, "Ah, your people are awaiting you, Lord Vorkosigan. I hope you found this educational, even if not to your needs. Good evening, then," and slipped promptly back into the sanctuary of the Star Crèche.

Oh, this whole thing is a learning experience, milady.

Miles fixed a friendly smile on his face, and trod forward across the walkway to the bench, where his waiting watchers rose to greet him. Mia Maz had her usual cheerful dimple. Was it his imagination, or had Vorob'yev's diplomatic affability acquired

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a strained edge? Benin's expression was less easy to read, through the swirls of face paint.

"Hello," said Miles brightly. "You, uh, waited, sir. Thanks, though I don't think you needed to." Vorob'yev's brows rose in faint, ironic disagreement.

"You have been granted an unusual honor, Lord Vorkosigan," said Benin, nodding toward the Star Crèche.

"Yes, the haut Rian is a very polite lady. I hope I didn't wear her out with all my questions."

"And were all your questions answered?" asked Benin. "You *are* privileged."

One could not mistake the bitter edge to *that* comment, though one could, of course, ignore it. "Oh, yes and no. It's a fascinating place, but I'm afraid its technologies hold no help for my medical needs. I think I'm going to have to consider more surgeries after all. I don't like surgeries, they're surprisingly painful." He blinked mournfully.

Maz looked highly sympathetic; Vorob'yev looked just a little saturnine. *He's beginning to suspect there's something screwy going on. Damn.*

In fact, both Benin and Vorob'yev looked like only the presence of the other was inhibiting him from pinning Miles to the nearest wall and twisting till some truth was emitted.

"If you are finished, then, I shall escort you to the gate," said Benin.

"Yes. The embassy car is waiting, Lord Vorkosigan," Vorob'yev added pointedly.

They all herded off obediently after Benin down the path he indicated.

"The real privilege today was getting to hear all that poetry, though," Miles burbled on. "And how are you doing, ghem-Colonel? Are you making progress on your case?"

Benin's lips twitched. "It does not simplify itself," he murmured.

I'll bet not. Alas, or perhaps fortunately, this was not the time or place for a couple of security men to let their hair down and talk shop frankly.

"Oh, my," said Maz, and they all paused to take in the show a curve in the path presented. A woodsy vista framed a small artificial ravine. Scattered in the dusk among the trees and along the streamlet were hundreds of tiny, luminous tree frogs, variously candy-colored, all singing. They sang in *chords,* pitch-perfect, one chord rising and dying away to be replaced by another; the creatures' luminosity rose and fell as they sang, so the progress of each pure note could be followed by the eye as well as the ear. The ravine's acoustics bounced the not-quite music around in a highly synergistic fashion. Miles's brain seemed to stop dead for a full three minutes at the sheer absurd beauty of it all, till some throat-clearing from Vorob'yev broke the spell, and the party moved on again.

Outside the dome, the capital city's night was warm, humid, and apricot-bright, rumbling with the vast subliminal noise of its life. Night and the city, stretching to the horizon and beyond.

"I am impressed by the luxury of the haut, but then I realize the size of the economic base that supports it," Miles remarked to Benin.

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"Indeed," said Benin, with a small smirk. "I believe Cetaganda's per capita tax rate is only half that of Barrayar's. The Emperor cultivates his subjects' economic well-being as a garden, I have heard it said."

Benin was not immune to the Cetagandan taste for one-upsmanship. Taxes were always a volatile civil issue at home. "I'm afraid so," Miles returned. "We have to match you militarily with less than a quarter of your resources." He bit his tongue to keep from adding, *Fortunately, that's not hard,* or something equally snide.

Benin was right, though, Miles reflected, as the embassy's air-car rose over the capital. One was awed by the great silver hemisphere, till one looked at the city extending for a hundred kilometers in all directions, not to mention the rest of the planet and the other seven worlds, and did a little math. The Celestial Garden was a flower, but its roots lay elsewhere, in the haut and ghem control of other aspects of the economy. The Great Key seemed suddenly a tiny lever, with which to try to move this world. *Prince Slyke, I think you are an optimist.* ■

TO BE CONTINUED IN THE NEXT ISSUE.

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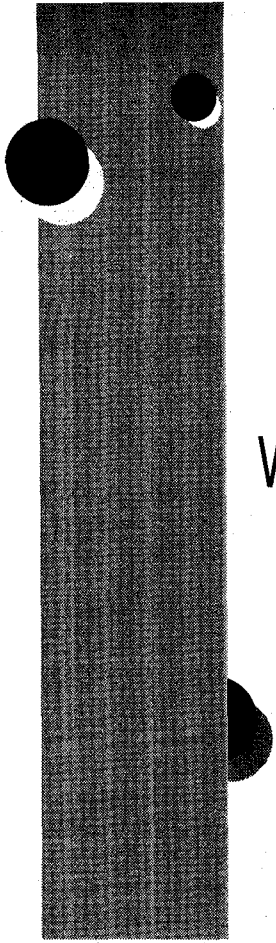

ANALOG
SCIENCE FICTION AND FACT

SALUTES THE WINNERS OF THE 1994 NEBULA AWARDS GIVEN BY THE SCIENCE FICTION AND FANTASY WRITERS OF AMERICA

Best Novel
MOVING MARS
by Greg Bear

Best Novelette
"THE MARTIAN CHILD"
by David Gerrold

Best Novella
"SEVEN VIEWS OF OLDUVAI GORGE"
by Mike Resnick

Best Short Story
"A DEFENSE OF THE SOCIAL CONTRACTS"
by Martha Soukup

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Shadow Man, Melissa Scott, TOR, $22.95, 320 pp. (ISBN: 0-312-85800-0).
Kaleidoscope Century, John Barnes, TOR, $21.95, 252 pp. (ISBN: 0-312-85561-3).
Fortress in the Eye of Time, C. J. Cherryh, Harper Prism, $22, 583 pp. (ISBN: 0-06-109295-9).
The Killing Star, Charles Pellegrino and George Zebrowski, AvoNova/Morrow, $22, 340 pp. (ISBN: 0-688-14153-6).
Kamikaze L'Amour, Richard Kadrey, St. Martin's Press. $20.95, 228 pp. (ISBN: 0-312-13160-3).
Armed Memory, Jim Young, TOR, $21.95, 256 pp. (ISBN: 0-312-85766-7).
Non Compost Mentis, Darrell Schweitzer, Zadok Allen: Publisher (order from Darrell Schweitzer, 113 Deepdale Road, Strafford, PA 19087), $3.75 (ppd), 30 pp., limited ed. (no ISBN).

With **Shadow Man,** Melissa Scott joins Ursula K. Le Guin and many other writers on that shelf-full of SF books that deal with variant sexualities. Scott's premise is that when faster-than-light travel becomes possible, humans will not be able to stand the experience without the aid of a drug. However (I won't say "unfortunately"), the drug triggers an unusual mutation in the human genome: the children of star-travelers come in five genders, male, female, herm, mem, and fem. Not surprisingly, the change comes as a bit of a shock to a humanity that tends to think of itself in he-she terms and condemn as sick or sinful any deviation from the standard partying line. Humanity draws back from the stars, abandoning its colonies while it thrashes out a response that not only recognizes all five sexes as equally human, but also admits to nine sexual preferences and accepts them all. Future humanity is a bit different from what we are used to.

Or is it? The three additional genders do have equivalents today, and our society is distinctly reluctant to call them "normal." Instead it calls them sick or sinful and exerts pressure to make them conform to the traditional either-or sort of sexuality. To guarantee that we do not miss this point, Scott sets her story on one of those abandoned colony worlds, Hara, whose people carry the mutation and have all five genders but recognize as legitimate only the

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traditional two. The other three must make up their minds at some point in their lives to be officially male or female; once they have done so, no further change is possible.

Yet the Concord—the mass of other human worlds, where all five genders are accepted—has rediscovered Hara, set up trade operations, and shown the local yokels that there is another way. Since the sophisticated Concordians are drawn to the innocent locals, and the locals are drawn to the accepting Concordians, and since Harans seem immune to all the many immunodeficiency viruses (HIVs) floating around the Concord worlds, there is a great deal of "trade" of another sort as well—casual pick-ups, long-term affairs, and prostitution. And if viruses aren't spreading, ideas are, and the local "wrangwys" (herms, mems, and fems) are itching to change their world's wrong ways. Alas, there is a power structure that has grown rich on the profits of trade (the second sort) and wants no change.

And here Scott begins. Warreven, a lawyer, once refused to marry the son of Hara's Most Important Man because he didn't wish to declare himself female. Tatian is a Concord trader. The two bump into each other at the courthouse and are attracted but do nothing. Warreven is maneuvered off a critical case the wrangwys hope will lead to legal recognition and into a position as his clan's sales rep. The police crack down on the wrangwys protest movement. Tatian helps. Eventually Warreven escapes off-world, vowing to return, equipped to be a more effective rebel.

Not much of a plot, you think? Well, no. It isn't. But the book is still very interesting, largely because of the issues it grapples with, the complexities and ambiguities it recognizes, and the relationships between the characters. I do not hesitate to recommend it, even though it does have aspects I found less satisfying. For one, the Haran language and society seem a rather strange mix of colonial French (Haiti, perhaps) and South African Boer. There are obvious reasons for using these models, but I don't think the mix works as well as it might. Perhaps it will work better for others.

John Barnes's latest novel, **Kaleidoscope Century,** is not for children. Its time is too bleak and its protagonist does far too many very nasty things—he enjoys "serbing" women—to expose to it those tender, impressionable little innocents. After all, they might take it as a recommendation, when Barnes is really trying to tell us that we have already settled our fannies into our handbaskets and pushed off the top of the Sarajevo bobsled run heading straight down the chute to hell. Perhaps he's also saying that we're going to have to be pretty nasty if we expect to survive the run; certainly his nasty protagonist is a survivor.

The tale opens with the awakening of Our Hero in a Sears Marshack. His memory is confused, full of holes and inconsistencies, but in the corner sits a battered werp (personal computer, communicator, database, archive,

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etc.) containing thousands of files he has apparently recorded at previous awakenings. He begins to scan them and soon learns that though the name he remembers is Joshua Ali Quare, he has also been James Noreen, Jason Testor, Ulysses Grant, Kindness O'Hart, and several more; his new identity is Reagan Foster Hinckley. As he struggles to make sense of the files and his fragmentary memories, the reader learns that he suffered a highly abusive childhood, ran away, was enlisted as a Communist agent, and when Communism died, found himself employed by the Organization, a stateless outfit that seems most concerned with maintaining its own power and privilege.

One feature of that privilege is the virus with which Our Hero was infected—it gave him perfect memory and a long life. The price of longevity is that every fifteen years he is stricken by a six-month bout of severe flu-like illness from which he recovers ten years younger, and with most of his memories of the previous fifteen years gone; hence all those files in the werp, his past attempts to give his life some continuity.

What does he do for the Organization? For one thing, every time researchers seem to be getting a bit too close to the Organization's technical secrets, he stops them. Usually that means murder, with serbing of wives and daughters. Our Hero has at least the grace to feel some guilt and shame; his best friend, Sadi (note the name), does not.

Memory and werp files both insist that Sadi has always been nearby. They have helped each other through many transitions, fought and serbed side by side as Earth has gone through a long series of upheavals, ending only when Resuna, an artificial intelligence, finally took over the minds of all the survivors on the planet. Our Hero and Sadi escaped to space, to Mars, and now. . . .

Well, Our Hero's memories are supposed to be fragmentary and confused, the werp files contradictory. Did he or Sadi kill or not kill and/or serb his foster daughter? All four possibilities are claimed. What's going on? Is this our future, even if it does have Yeltsin jumping up on that tank and getting murdered on the spot? Yes and no and maybe, in a beautifully multivalent ambiguity that surely owes a little to Heinlein.

The key lies in the simple fact that as Our Hero narrates his tale the details come far more richly than should be possible. That bothered me, but Barnes can be trusted. In time he makes this inconsistency make sense. In the process he reveals a love affair that conquers time and space and history, as well as a frightening lust for power.

Kaleidoscope Century would be a tour de force if at the very end Barnes did not strip his hero of his saving grace—which makes it even less for the kiddies.

The puff sheet that accompanied the galleys of C.J. Cherryh's **Fortress in the Eye of Time** called the book "Major . . . an epic fantasy that surpasses all of her previous bestsellers." Those words will surely also appear

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on the book's jacket—and they may even be right. The book has a few flaws, but overall it made me think it one of the very few fantasies that deserve to share shelf-space with the works of J. R. R. Tolkien.

Cherryh's tale begins in an isolated, ruin-girt tower, last remnant of Ynefel that had once been Galasien in an age before the age of Men. Here dwells the wizard Mauryl, gray and worn with years past counting and fully aware that the enemy that prompted him to bring down both the Galasieni and the Sihhe of Ynefel is returning once more, audible in the wind that whispers at the edges of doors and pries at the shutters, visible in the Shadows that loom with the fall of night, gaining strength, threatening all and everything.

What can a worn-out wizard do but gather his magic and summon a spirit, a soul, a being, its source unspecified? Yet this wizard has doubts about his own strength and rightness, and those doubts weaken his summoning. What materializes from the air is a young man with no awareness of his identity or nature or purpose. Mauryl is frustrated, for now he must teach his creation everything—eating and reading and common sense, and even a name, Tristen.

Fortunately, the teaching goes quickly. Certain things seem inborn in Tristen—language for one, honesty for another—and he seems to recognize many other things. Their names are Names and Words that awaken in him webs of associations, whole skills and competencies. What he never seems to gain is skill at connivery and deceit; he is and remains a naif, yet one that cannot easily be deceived by the whisperings of wind and Shadow. Nor is he remarkably clever; Mauryl gives him a book which, if he can only read it, will explain much of his mission in this world. Yet the book's lettering refuses to make sense to his eyes. Soon thereafter his beard begins to grow, and Mauryl gives him a mirror and a razor. The mystery remains in-Vinci-able.

And then the enemy returns, mightier than ever. Mauryl dies. Tristen, still a naif, takes to the Road through the haunted wood. He follows it, hungry and faint of heart but faithful to Mauryl's last instructions, until he reaches the walled city where the prince Cefwyn struggles to tame a sullen province of his father's empire. Recognized as Sihhe in form, feared and suspected as a remnant of a people now anathema, he is brought before Cefwyn, where he tells of Mauryl's fate. Soon he is a member of the court, a bit peripheral, treated warily, but nonetheless a member. He is thus present as events take ominous turns, the enemy becomes apparent even this far from Ynefel, and the Words of riding and war stand ready for his recognition. It is not long at all before it is clear that in Tristen stands a Hero of a bygone age, the sole hope, perhaps, of the present, if only he can puzzle out the secret of his little book and find the necessary answers to the Shadow on the horizon.

There is a mighty inevitability to this novel's flow, a sureness of precisely the sort Cherryh has taught us to expect of her, lessons of faith and

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honor and innocence, and a hero with whom one can fall quite in love. Fantasy fans, and SF fans who delight in Cherryh's SF novels, will love *Fortress in the Eye of Time.* Don't let it slip past you.

What about the flaws I mentioned? One is that the villains are not nearly as well realized as the heroes and even some of the spear-carriers. Another is that little book, for of course Tristen does eventually, after a great deal of frustrated reflection, twig to its secret, and that secret seems rather less than crucial—unless Cherryh is planning a sequel.

Charles Pellegrino co-designed the *Valkyrie* anti-matter rocket, co-predicted the discovery of oceans inside certain icy moons of the outer Solar System, and originated the notion of cloning dinosaurs (which led to *Jurassic Park).* He's had so much trouble getting his ideas taken seriously—except by his severest critics, who later claimed possession of those same ideas—that his New Zealand university chased him out of town with the words, "You think in strange ways, and I don't know how we are going to bang it out of you. Sooner or later you'll be writing science fiction, and then you'll really embarrass us all."

So, of course, he started writing SF. A year ago I reviewed *Flying to Valhalla,* which showed us the *Valkyries* in action and introduced us all to the idea of a paranoid universe, in which pragmatic intelligent species must respond to even a small probability of threat from other worlds by destroying any world that brings itself to their attention by emitting TV and radio signals or—worst of all—by deliberate transmissions to the stars, such as we have indeed sent forth. The weapon of choice, he suggested, would be relativistic bombs, masses designed to strike a planet at such a high fraction of light-speed that colossal amounts of energy would be released and the planet would be sterilized.

Now Pellegrino and George Zebrowski have gotten together to write **The Killing Star.** It's not really a sequel to *Flying to Valhalla,* though the past alluded to here does seem to include at least some of the events in the earlier book. More to the point, many of Pellegrino's concerns remain, notably the interstellar paranoia and relativistic bombs, for the book opens with the arrival of the bombs and the utter devastation of Earth and most of its colonies and research stations in the Solar System. The few survivors include two researchers examining the *Titanic* in a much-improved *Alvin,* the residents of a hollowed-out Ceres, a research crew who will try to hide inside Neptune, another crew who will fly their comet inside the Sun, and still another group—including clones of Buddha and Jesus—who will head for a brown dwarf beyond the Oort Cloud. Most are not successful, for hot on the heels of the bombs come the exterminators.

This is definitely bleak, apocalyptic stuff. The plot is simple—unrelenting catastrophe, with the few survivors scurrying for and pulling in after them any holes they can find—but it's the

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hardest of hard SF, as classic as it comes in the sense that it has plenty of desperate engineers pulling tricks out of their hats just in time to save the day and that the characters are quite incidental to the story. It is less classic and more modern in its pervading—and realistic, given the premises—sense of futility.

It is also an extended meditation on the proper approach to the Universe. Should we be vengeful warriors or pacifists? And what *is* the proper interpretation of Buddhism's wheel of existence?

There is a hint that there will be a sequel centering on Jesus's daughter, Cherene. Where did she come from? Don't ask. The authors, hastening toward their concluding paragraphs, plunk her into the middle of the page with no mention of a mother. But as I said, the characters are quite incidental in this sort of story.

I found Richard Kadrey's **Kamikaze L'Amour** impressive but so intensely, metaphorically overwritten that it was impossible to suspend my disbelief.

This is a killer comment only if you believe suspension of disbelief is essential to true enjoyment of a story. Some of you surely do not, for there is a definite place in literary art for the unbelievable, overwrought metaphor, just as there is in the visual arts, where Kadrey also works (for instance, his collages accompanied Lee Ballentine's *Dream Protocols* poetry collection). Here the metaphor centers on the revenge of the abused rain forest, which has exploded northward into California, producing quite enough social chaos for a dozen novels but leaving Hollywood untouched in its already lush and florid essence.

Kamikaze L'Amour begins with the attempted suicide of rock star Ryder, who has the curious talent of synesthesia (he sees sounds and hears sights). Revived in time, he is packed off to a high-priced loony bin reminiscent of a certain cuckoo's nest, while the world's press pursues a thousand rumors of his fate. In due time, he escapes the booby hatch, decides to use one of his many other names to escape show business, and goes to San Francisco, surrounded by rain forest. He seeks out Virilio, a fixer who can get him decent fake ID and supply him with drugs. He meets Frida, who is in desperate pursuit of the music of the newly rain-forested landscape (in "Horse Latitudes," the 1993 version of this story, Kadrey introduced the concept of the "music of the land," which must be sought, played, and mastered) and immediately sees that his equivalent pursuit is for the music of cities.

Here, perhaps, we see the heart of Kadrey's central metaphor: Frida is an everywoman, her name belonging far less to her (her real name is Catherine) than to the holder of a particular job, the occupant of a role. Her name echoes the Norse love-goddess Freya, who loves music, spring, flowers and elves. Her music, built of rain-forest sounds, seems quite New-Agey.

Ryder, man on top and pun intended, also loves music, but his music is an urban thing, all power, fame, and wealth, not pastoral, not con-

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nected to nature. He is as primordially masculine as Frida is feminine.

So what happens to them? Ryder finds himself being followed. His apartment is looted, the few fragments of music he has written in his exile stolen. The same thing happens to Frida. Virilio intimates that he is in touch with Powers from Ryder's pre-suicide world, and they want him back. Frida vanishes. Ryder and Virilio head south, toward Los Angeles and Hollywood, toward a shaman-led spirit-walk and an earth-shattering finale that leaves masculine and feminine pursuing the same goal in separate ways, destined to come together if and when they succeed.

Jim Young's **Armed Memory** is flawed by a bogeyman that just does not make sense, but it is such an exciting, fast-paced thriller that it will undoubtedly make cents for both author and publisher.

The premise is that not too far into the future tailored viruses will make it possible to redesign (micro-design) bodies at will. Ordinary folk turn themselves into look-alikes of Elvis and other stars, grow into giants, add on muscles, and so on. When country-boy Tim Wandel comes to the city, he runs into his cousin Johnny all rigged out like a pangolin and remembers that Johnny always wanted scales. He soon learns that Johnny runs a fashion house, Microde City, that creates and markets new body designs. Then Johnny offers him a job in the PR department, but only on the condition that he have himself microded like all the rest of his loyal employees.

Tim is thus on the scene for what happens next, which depends on the existence of the hammerheads, gangsters who have redesigned themselves as hammerhead sharks. The hammerhead foot-soldiers look mostly human, except for the lateral bulges in their skulls. The kingpins are truly sharks, hiding in the sea, with the top ranks enlarged to the size of whales. It soon becomes clear that their aim is to wipe life off Earth's land and return it all to the sea, thus correcting a fundamental error made eons ago and restoring predator heaven. Young hints that the source for this grandiose ambition lies in certain Asian sects that worship the shark, but he did not come remotely near to convincing me.

The hammerheads were made possible by technology stolen from Johnny's research lab. Johnny therefore feels an obligation to remove the threat to the world that theft created. The very day he is announcing the new season's designs, he therefore reveals that his researchers have come up with a way to reverse microding (making it possible at last for people to change their minds) and that he is giving the design for an anti-hammerhead virus to the UN.

Not surprisingly, the hammerheads object. Their footsoldiers hit the streets with everything from frenzied attacks on the citizenry to missile attacks on Microde City's headquarters and labs. Unfortunately, it is too late. Johnny has already released the new virus.

Is the crisis over? Not for Microde City's survivors, faced with a govern-

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ment "How dare you release a virus!" hissy fit that puts several characters in jail and sends Tim back to the countryside. Nor for civilization, for the hammerhead honchos still survive in the depths of the sea, and they are not giving up. Fortunately, Johnny foresaw the problem and set in motion events that would give Tim the money and clout to do something about it all.

The basic plot is simple. The characters are thin. The villain is unlikely. But Young is dealing with a serious issue here—the possible misuse of a new technology with enormous potential to manipulate bodies and minds for good, for ill, and for repairing the ill. At the end of his book his characters are aware of that potential and are prepared à la Jefferson to swear vigilance against tyrannies over the human mind. That's a point worth making, and perhaps it is not a surprising one to come from a U.S. diplomatic corps political officer (he currently works in the American Embassy in London).

What is **Non Compost Mentis?** Darrell Schweitzer's subtitle is "An Affrontery of Limericks and other Eldritch Metrical Terrors," so now you know. It collects a number of his light verses from such sources as *Amazing Stories, Crypt of Cthulhu, Weird Tales,* and *Shudder Stories.*

That's right: Cthulhu limericks, like this one, which Darrell refuses to complete in his puff sheet (but does in his chapbook):

A cultist entranced with Cthulhu,
Encountered a slavering ghoul who
Said, "Old Ones don't need me,
They won't even feed me—
. . ."

I don't hold much brief for the Cthulhu cult. It seems to me far too musty—indeed, it was musty when it was new—to warrant all the creepy short stories, novels, comic books, and sub-B movies it has spawned. So a slew of disrespectful limericks appeals quite nicely. Some of the individual limericks appeal even more, for Darrel can be a clever, witty fellow.

Is he clever enough for 25 verses to be worth a bit less than the cheesiest of paperbacks? In a word yes—but supply is limited, so order now. ■

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BRASS TACKS

Dear Dr. Schmidt,

I was flabbergasted to find out from Grey Rollins, in your January Brass Tacks column, that the stock market crash of '29 caused the Great Depression. I expect to find out next that the taking of Fort Sumter caused the Civil War.

It's true that the panic of '29 started the collapse of a vast credit bubble, but it wasn't even the cause of that, only the first symptom. It's also true that by '33, stocks had lost 83% of their value. This is a ghastly devaluation, but the country has taken similar hits at other times without going through a ten-year depression. I'm thinking particularly of 1837, 1857, and everyone's favorite, 1988, where a hit not quite that vast, but vast enough, took place in one day. When speculative bubbles burst, economies typically pull up their socks and recover within a year or two. Why didn't this happen in '29?

Economic historians hold that government mismanagement—the "American socialist era"—caused the Depression. To mention just the biggest mistakes, there was the Keynesian policy of inflation, the outlawing of gold, the horrendous tax rates on the rich (wiping out savings and preventing any accumulations of capital for the economy to pull up its socks with), the bullying of small businesses by the National Recovery Act, and, some say, the refusal to permit wages to drop to their natural level.

Furthermore, it's believed by some that the bubble that started the problem grew out of government policy, especially the Federal Reserve Act of 1912, which enabled the government to defer the cost of World War I.

Cause and effect are no easier to discern in history than in physics, but many brilliant men have worked on this problem, and a writer who creates libertarian societies should be up on it, especially as it might have increased the depth of the story in question. (Not to suggest the start was shallow.)

On the subject of Martians, incidentally, Clifford Simak (I believe) once wrote a novel called *They Walked Like Men* in which the aliens turned themselves into banknotes and bought most of the United States before the citizens knew they were here. Maybe the Martians *do* own San Francisco.

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The author replies....

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Perhaps Mr. Conolley did not read "Darwin's Children" (October, 1993), the first story in this series. In it, I made clear that the background was quite a bit more complex, specifically mentioning monetary policy in the narration near the end of the story.

As should be apparent to those who have read the stories, I agree with Mr. Conolley's assertion that governmental mismanagement was part of the problem. That's why you'll find subplots throughout the series that hint at nearly every point that Mr. Conolley makes in his third and fourth paragraphs. To make the points more explicitly would bog the plot down—my intent was to write a story, not a financial treatise.

In my response to the letter in Brass Tacks, I used the word "caused" in the sense of the straw that breaks the camel's back, i.e. a trigger. I trust that other readers were able to pick up on that interpretation. In his second paragraph, Mr. Conolley states that the '29 market crash "started" the economic collapse. I don't think it's too great a leap from Mr. Conolley's use of the word started to my use of the word caused.

Incidentally, I was flabbergasted to find out from John Conolley that there was a market crash in 1988. The last I heard, it was in 1987. . . .

GREY ROLLINS

Dear Dr. Schmidt:

I am in general agreement with the ideas expressed in your editorial "Excuses and Evolution" (February, 1995). In the absence of significant organic factors (e.g. severe mental retardation or endogenous psychosis), each adult must hold themselves responsible (*"mea* culpa") for actions that are morally wrong or lead to bad results. An "explanation" for an action does not necessarily constitute an "excuse"—and, by the very nature of the situation, the person who did it *cannot* be totally objective regarding this judgment.

However, unless I am mistaken, you seem to imply at one point that it is possible to literally, biologically, "breed for character," by letting those who make "stupid," life-threatening choices kill themselves off, "hopefully before they reproduce."

Certainly, genetic factors do help determine human behavior. For example, there are rare disorders of metabolism (e.g. Lesch-Nyhan disease) associated with behavioral problems which follow simple Mendelian inheritance. Far more often, however, inheritance of undesirable behavioral traits or disorders is highly variable and poorly predictable. As another rather extreme example, adults with Antisocial or Borderline Personality Disorders are indeed more likely than the general population to produce offspring with these problems.[1] However, it is much more likely that their children will *not* develop these disorders, especially if they are exposed to a "nurturing" environment. Conversely, parents who are "well-adjusted" and "smart" can nonetheless produce offspring who are not.

Although genetic influences on behavior may indeed be apparent and their consideration appropriate when one looks at small groups of individu-

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als, at the level of a large population (e.g. the entire United States) they are very weak and uncertain. Ignoring the (probably very important) environmental/social elements of your proposal, from a strictly biological standpoint, if the passive eugenics you seem to advocate would be successful at all (and even that is very doubtful), it would probably take many generations to become apparent at the level of "society" as a whole.

I heartily concur with your point that individuals should not be overprotected from their mistakes, and should both take responsibility for and learn from them so that they can avoid them in the future. However, I cannot agree that the *laissez faire* approach you advocate should be applied when the bad consequences are likely to include serious physical injury or (especially) death. None of us is so perfect that, over the course of our lifetimes, we don't do some things, or develop some habits which are "stupid" and could, with varying degrees of probability, potentially result in death. From time to time, we all could use a helping hand. Whether viewed from the standpoint of compassion or pragmatism ("dead persons cannot learn from their mistakes"), I believe it is both reasonable and necessary to consider, for specific individuals or problems, whether intervening might be beneficial without being "overprotective."

In fact, as a physician, it is my *duty* to intervene when patients are doing things which are medically "stupid." Whether these behaviors are intrinsically "high risk" and/or considered by some to be "immoral" (such as unsafe sex practices or substance abuse), or are more socially acceptable, prevalent, and/or have a lower "stupidity quotient" (such as being overly fond of cholesterol-rich foods), I am obligated to use measures like standard counseling and education techniques to try to dissuade them. "Worse," I often wind up "protecting" them from the natural consequences of their actions (e.g. treating the acute complications of the myocardial infarction a person who continues to smoke finally has). If this makes me an enemy of "evolution" and "survival of the fittest"—so be it.

On the other hand, I know that there are very severe limitations to how much it is possible to help others. A person can always choose not to listen to or to act on even the best advice. If they wish, they can easily circumvent measures which might be effective in helping them (e.g. it's possible to mandate that all cars have seat belts, but impossible to make sure that everyone always uses them). For many problems it may not be clear what *is* the "best" advice or action to take, or if it is really practical or even possible to provide effective help. And, there can be a very fine line between an "appropriate" degree of protection, and an overprotection that masks more serious problems and can even, paradoxically, encourage "stupid" behavior.

Any help we do provide for others can, at best, only supplement, and never be a substitute for the duty of each person to take responsibility for

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their own actions. If this responsibility is not taken seriously enough, then whether we like it or not, "evolution"—a process which, unlike human beings, does not feel compassion, and is not forgiving of mistakes—will, indeed, occur.

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1. American Psychiatric Association: Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition. Washington, DC, American Psychiatric Association, 1994.

You're quite right that the genetic *evolutionary part of this business is small and slow. Interestingly, most readers who commented jumped all over that (which I originally saw as an almost tongue-in-cheek afterthought to my essay) and largely ignored the main thrust, which is the* memetic *evolution of the society (which is* not *small or slow). A civilization can hardly be expected to improve by encouraging the spread of the meme, "It doesn't matter if I* act *stupid because somebody will bail me out!"*

Physicians, by the way, are in a rather special situation. It is *your duty to intervene when your patients do "medically stupid" things —provided that by intervention you mean treatment of disorders and the kinds of advisory measures you mention. But you can't* force *them to follow your advice, and neither they nor you should consider it* your *fault if they harm themselves by failing to do so.*

* * *

Greetings,

Your editorial, "Excuses and Evolution," shocked me. What started out as a thoughtful analysis of individual responsibility quickly deteriorated, after fathomless flights of fancy and loose leaps of logic, into a nefarious apology for barbarism, clearly inconsistent with the Judeo-Christian tradition of promoting individual responsibility on the basis of the belief that every human being has intrinsic value.

Some days before I read your piece, the Discovery Channel broadcast a program entitled, "Selling Murder." The documentary outlined the evolution of Nazi propaganda serving their effort to find a solution for dealing with the disabled and with "social and criminal deviants." In the early years, the Nazis identified the "deviants." Then they said deviants cost society too much. The Nazis next suggested that deviants really wanted to die. Later they concluded deviants did not deserve to live. Finally, the Nazis decided to gas them, and did.

Your argument breaks down, and turns into a fallacious non-scientific non sequitur, when you shift your discussion to society and ask the question, "But is it equally good to protect people without the moral judgment or emotional self-control to refrain from killing people, or the common sense from killing themselves?" You conclude with an un-American, barbaric imperative: "Let those who are too stupid to take precautions kill themselves—hopefully before they reproduce." You cannot use science to justify this irrationally subjective

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point of view. You're one step from the Nazi "Final Solution."

You can only reason like this if you believe that some human beings are intrinsically worth more than others. You may recall that this belief was the cornerstone of Nazi philosophy.

Those of us who believe that all human beings have intrinsic worth—as articulated in our Declaration of Independence—believe rational social institutions will successfully pass on to future generations the moral values necessary for responsible social behavior. When behavior becomes increasingly barbaric, we conclude that social institutions are not doing the job. The rational policy is not the one that promotes individual self-destruction as you have, but the policy that contributes to individual self-realization through rules that meet human needs.

The sad fact is that, during the last 25 years, laws and policies have unjustly and unfairly served the interests of a few at the expense of the many. As society becomes increasingly unjust, it becomes increasingly barbaric. While each individual is responsible for his acts, social science will verify the validity of the hypothesis that people naturally act less responsibly in a society that removes incentives for behaving responsibly either by unfairly and unjustly favoring one group over another or by exhibiting unfair and unjust procedures and practices, such as those manifested in our legal system.

Given these arguments, I hope you will provide some reasonable clarification, for I cannot believe you intended the shameful implications of your editorial.

CHARLES J. REID

Santa Cruz, CA

The Nazis created their own definition of who should live and actively tried to exterminate those they didn't select. Far from suggesting anything like that, I advocated only refraining from artificially protecting people from the consequences their actions would have in the absence of such artificial protection. There is an enormous fundamental, qualitative difference between those two things. If you see one of them as "one step from" the other, you're in a very poor position to accuse anyone of "loose leaps of logic."

Dear Stan,

I just finished reading your February 1995 editorial, "Excuses and Evolution," and I have a couple of stories, *true* stories, that will astound you. You may or may not have heard them already, but a suspension of disbelief might be required.

Case 1: An elderly woman receives a cup of hot coffee at a McDonald's drive-through. A plastic cap is firmly in place over the lid. The woman puts the cup between her legs while driving, *takes the cap off,* and spills it on herself after hitting a bump in the road. Needless to say, the hot coffee scalds her. She sues McDonald's for two million dollars and *wins,* the claim being that the "coffee was too hot."

It gets better.

Case 2: A *burglar* has climbed to

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the roof of the house he's decided to burglarize, seeking a way in. He puts his weight on a skylight and it gives away, causing him to fall through into the house, and to be knocked unconscious. The family comes home to find him lying there, and he's taken away by the police. The burglar sues the company who makes the skylight for over a million dollars and *wins,* the claim being that the skylight is "dangerous" and "unsafe."

When I hear about cases like these, I feel as though I must have been born on another planet where things make sense. If I were a judge, I would have thrown both of these cases out as soon as they were presented to me. If I were a juror, I would never have been selected after I laughed out loud and asked the lawyers if they were joking.

The lady in Case 1 is clearly at fault—the plastic lid that restaurants place on the cups are to prevent spilling, and if a person chooses to take the risk of removing it and drinking the coffee while in a moving vehicle, they should understand the risks involved and be prepared to accept any possible consequences.

The burglar in Case 2 should not have been burglarizing, and the fact that he received compensation for a negative act goes beyond ridiculous. Nowadays, it seems, people aren't required to be responsible for their own actions, and sometimes they are *rewarded* when they should be punished. No, I'm not a supporter of Draconian-type laws, but I do believe that people should stop trying to assign guilt and blame to forces outside of themselves in cases where they are clearly at fault.

SCOTT L. TOWNER

New York, NY

Dear Stan;

I have been a Sci-Fi fan for years but never read any Sci-Fi magazine. This fall I decided to treat myself to a subscription to *Analog,* just to see what it was like. I am sure glad that I did, and I am most happy to renew my subscription. It has broadened my experience of Sci-Fi. Before I pretty much stuck to Asimov, Bradbury, etc. . . . but now I am reading stories by the current greats who I was ignorant of.

I am also impressed by your editorials. I especially like the one in the February issue, "Excuses and Evolution." I am a psychologist at a rural mental health center, and it seems that I spend most of my days listening to people make excuses about why they cannot work, or are abusive, and so on. I try to help them take responsibility for who they are now. Carl Jung once said, "the process of growing up is becoming responsible for that which we were not responsible for." While a person may not be responsible for the abuse or neglect they suffered as a child, they are responsible for the way they respond to it; or as a client put it after months of therapy, "life is like a card game; you might not control the cards you are dealt, but you are responsible for how you play them." Your editorial made me think that maybe humanity is starting to suffer from cultural entropy; the more we advance, the more we are able to take care of those of less sur-

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the roof of the house he's decided to burglarize, seeking a way in. He puts his weight on a skylight and it gives away, causing him to fall through into the house, and to be knocked unconscious. The family comes home to find him lying there, and he's taken away by the police. The burglar sues the company who makes the skylight for over a million dollars and *wins,* the claim being that the skylight is "dangerous" and "unsafe."

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Scott L. Towner

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vival ability, and of course they reproduce at a higher rate than the hard working, responsible people. Eventually the deadbeats will greatly overwhelm the producers and society will collapse. Hey, maybe that would make a good short, Sci-Fi story for a budding writer (kind of similar philosophy of Grey Rollins Dec. '94 story).

Again, keep up the good work. I love *Analog*.

JOHN C. GARRETT

Tell City, IN

Dear Dr. Schmidt:

Hurrah and thanks for finally joining the 'net. In the spirit of connectivity, would it be possible for you to publish the e-mail addresses of authors, illustrators and other contributors, if they have such and give permission, with the other credits?

Is it possible to submit AnLab votes to this e-mail address?

And is there an electronic index of issues available?

Thanks for a moment of your valuable time.

JOHN HARDIN

(via compuserve)

We don't give out contributors' addresses, but have long been willing to forward paper letters addressed to them c/o Analog. We still don't want to publish any sort of addresses—our credit areas are crowded enough already, and some contributors might not want even their e-mail addresses published. However, many of them are on one or more of the services, and you can get their addresses through those directories.

AnLab votes by e-mail are quite welcome; and while we don't have an electronic index yet, I hope we will eventually. ■

We welcome your letters, which should be sent to *Analog*, 1540 Broadway, New York, NY 10036. (CompuServe: 71154,662. Internet: 71154.662@compuserve.com.) Space and time make it impossible to print or answer all letters, but please include your mailing address even if you use e-mail. If you don't want your address printed, put it only in the heading of your letter; if you do want it printed, please put your address under your signature. We reserve the right to shorten and copy-edit letters.

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UPCOMING EVENTS Anthony Lewis

26-30 Oct

21st WORLD FANTASY CONVENTION at Inner Harbor Marriott, Baltimore, Md. Guests of Honor—Rick Berry, Terry Bisson, Lloyd Arthur Eshbach, Lucius Shepard, Howard Waldrop. TM—Edward Bryant. Registration—$85 until 1 July, there higher. Info: Baltimore Gun Club, Box 19909, Baltimore MD 21201-090.

17-19 Nov

PHILCON '95 (Philadelphia area SF conference) at Adam's Mark Hotel, Philadelphia, Penna. Principal Speaker: Jack Williamson, Artist Guest of Honor—Bob Eggleton, Special Guest—Connie Willis. Registration—$25 in advance, $35 at the door. Info: Philcon 95, Box 8303, Philadelphia, PA 19101. (215) 342-1672. kunga@netaxs.com

1-3 Dec

STELLAR OCCASION (Dallas area SF conference) at the Harvey Hotel Addison, Dallas, Tex. Author Guest of Honor—Ben Bova, Industry Guest of Honor—Barbara Bova. Registration (to Phoenix Entertainment) $25. Info: Stellar Occasion, % Meri Hazlewood, 810 Blossom Rd, Garland TX 75041.

29 Aug-2 Sep 1996

L.A.CON III (54th World Science Fiction Convention) at Convention Center, Hilton, and Marriott Hotels, Anaheim Cal. Guest of Honor—James White; Media Guest of Honor—Roger Corman; Fan Guests of Honor—Takumi and Sachiko Shibano, Special Guest—Elsie Wollheim, TM—Connie Willis. Registration—$90 until 30 June 1996, $110 until 31 December 1995, then higher. Child-in-tow (3-12 in 1996)—$35, infants—free, Supporting—$30. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Join now and get to nominate and vote for the Hugo Awards and the John W. Campbell Award for Best New Writer. Info: L.A.-Con II, % SCIFI, Box 8442, Van Nuys, CA 91409. lacon3-info@netcom.com

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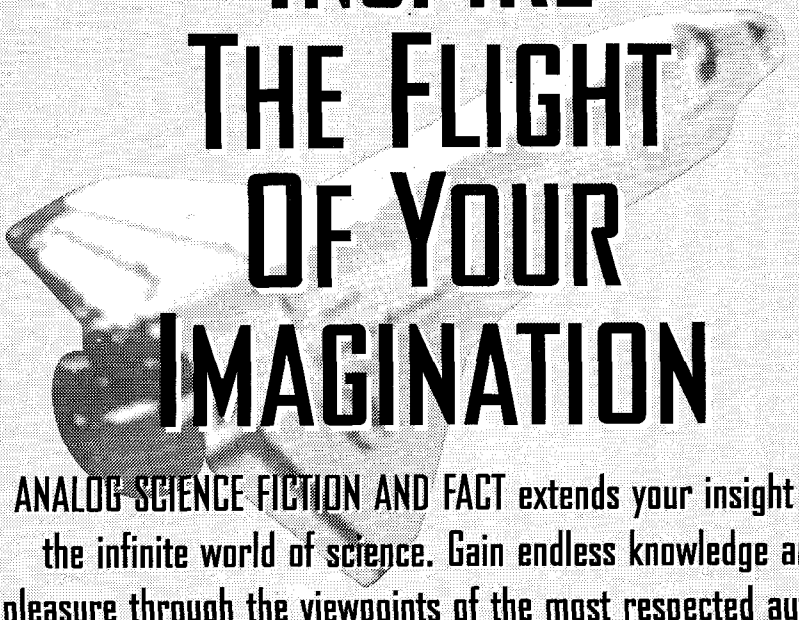

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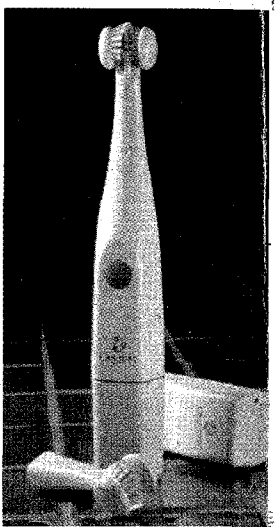

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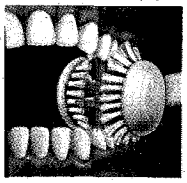

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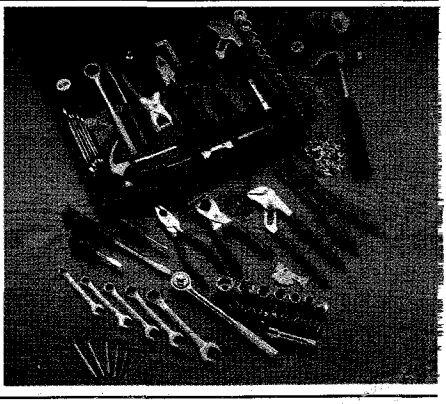

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